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Development and Application of the High-Production Machine

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FOR large scale production three fundamental principles are demanded, though these in some cases may be only relative, and may vary greatly with the class of work. These fundamentals can be stated briefly as: Straight line handling, subdivision of the work, and the economical subdivision of labor.

Where the work in production must be carried from one machine to another, from one section to another, or from one department to another, time is inevitably lost in re-chucking, re-handling, and in the transportation confusion resulting from the criss-crossing of work en-route between operations. Moreover, serious efficiency losses are often encountered by the transference of production control between different foremen or section bosses. In one of the war-time gun factories, operating under the plan of sectional division of machines, an analysis showed that more than $100,000 worth of a certain part was continuously in production between the operations. When the equipment was rearranged, and the inter-sectional demands for "stock" ahead were eliminated, this permanent investment of parts in process was cut down to less than $3,000 without hindrance to any operation.

Subdivision of work and subdivision of labor are interrelated. The machine that attempts all operations at one spindle must either process them in sequence, which is extravagant of time, or else force a group of tools to work, regardless of the requirements of feed and speed. Where the single-spindle machine is provided with feed and speed changes in order to accomplish more than one operation at a single chucking and single handling, the total time of the piece in progress must inevitably be the sum of all the operations.

In the planning of operations to incorporate the three fundamentals of economic mass production just mentioned, not only must plant layout be designed to reduce transportation and inter-sectional work control, but serious study must be given in advance to the type of machine best suited for the job. The three fundamentals must be applied to the machine itself, and the maximum of operations incorporated within one machine consistent with the proper subdivision of the work and labor.

> Modern high-production machines are based on the principles of the machine tool, but their successful design to meet competitive conditions must also incorporate the basic principles of good management, which include reduced space, less skilled labor, smaller work-in-process inventories, reduced handling time, and maximum production

There is no well defined line between the machine tool and the production machine, and the former often becomes a production unit by its simple application to the continuous reproduction of one or more commercial parts. The turret lathe and other specialized machines are the outgrowth of machine tools, and practically every single-purpose production machine embodies the principle of one or more of the common types of machine tools. But the choice in the selection of the specialized high-production machine is becoming more and more outside the scope of the merely shop function, and requires more careful study by production engineers and by the management.

The job shop handling single pieces, or very small lots, can often work most economically with an assortment of standard machine tools, while at the other extreme is the modern manufacturing shop requiring the production of large numbers of duplicate parts in continuous quantities day after day. Where this manufacturing condition becomes highly competitive, as in the automobile industry, the management must incorporate in advance all three fundamental principles of mass production into both plant layout and machine selection. In the high-production machine every item of time, labor, and space-saving must be carefully studied. Chucking time must be reduced, all hand feeds eliminated,

and space must be cut down by more production per unit, and by a combination of machines into one unit.

The universality of the engine lathe for boring, turning, and facing brought it into early use as a production machine. It is within the memory of even some of our younger manufacturers when factories producing staple commercial articles such as typewriters or phonographs had long lines of engine lathes each doing one of several standard operations on the commercial parts. This led to the one-operation machine, or machine tool arranged for producing one job continuously. It was not even uncommon to see an old engine lathe rigged up as a permanent screw slotter with a saw on an arbor and a sliding block in the cross-slide.

Single-Purpose Machines

The same principle of transition from the machine tool to the one-operation machine, and later to the modern high-production machine for many operations, holds true for other types of machine tools as well as for the lathe. Where an article is to be reproduced continuously in large numbers, the modern tendency is to call for a design of machine that will turn out the part with the minimum attention or skill of the operator devoted to chucking or changing feeds and speeds. But very few plants have the need for high-speed production of all parts at all times. A one-job machine can often produce enough of one part in one day to stock the requirements of assembly for a considerable period. Where a machine can then be designed to maintain the principles of the one-job machine, and to be adapted to other jobs of somewhat similar characteristics without undue cost of change-over, a decided step has been gained for the production shop in the eliminating of expensive idle machinery. This is the present tendency in the demand for production machinery, and machine tool builders have met it with the modern high-production single-purpose machines. The automatic production surface grinder is an example of the evolution of the old toolroom or general shop grinder to the modern machine with rapid-acting chuck, automatic-positioning table, rapid lever-governed speeds and feeds, and automatically governed flow of cutting lubricant.

The lathe, however, with its vertical complement, the boring mill, offers the finest illustration of the development of the modern high-production machine from the standard machine tool. Out of the lathe principle was evolved the screw machine, the turret lathe, and the modern specialized, automatically governed, high-production machines. The screw machine in its highly developed state, is applied most effectively to the continuous production of parts from bar stock, and as such can be operated as a fully automatic machine. The application of the screw machine turret to the production chucking lathe, which advanced it a step further from the standard engine lathe, reduced materially the lost time of the operator in chucking and in resetting tools, and the specially built turret lathe will continue to have a wide demand for turning duplicate parts in medium-quantity lots.

But modern high production was only attained effectively in the single-purpose machine when the mechanical skill required of the operator was cut down, transportation and rechucking of work were eliminated, and when the total time per piece was limited to that of the longest operation. An objection raised against such machines is that they are subject to long periods of idleness unless the parts to be manufactured are required in exceptionally large quantities. This is only partly true, because the single-purpose machine of today is not merely a one-job machine. The modern high-production machine can be changed from one job to another as long as the jobs fall within the purpose or sphere of the machine. Machines of this type are being effectively changed over on production work to handle varying lots of parts requiring turning, boring, facing, or drilling.

Moreover, it is being demonstrated daily that periods of idleness for this class of machine can be tolerated and that the unit overhead cost can be kept below that for a general-purpose machine on production work. While the cost of the high-production machine is generally great, its speed of production often permits it to replace a number of single-operation machines, the combined idle time of which may exceed that of the single-purpose machine.

While the operator on the lathe can sometimes run more than one machine on production work, it requires more skill to do so than for the operation of the single-purpose machine. On the latter, the operator not only handles more than one machine, but his entire cycle of operations is going on continuously on each machine without physical effort on his part. Recently, in a shop where several chucked jobs were being run on production in lots of a few hundred each, single-purpose machines had been used. The machines were tooled up in about an hour and then run continuously for one or more days, one operator sometimes handling two or more machines. A single-purpose multi-spindle machine was installed, which took as high as five hours for set-up to change jobs. But the production was increased from 1 to 6 on some pieces and from 1 to 10 on others, and the savings were enough to pay for the machine in about 15 months of operation.

Multi-Spindle Operations

Any piece of duplicate work ordinarily done in the engine lathe or in the turret lathe is capable of being done in a machine of the automatic multi-spindle type, and without the losses of time from re-chucking in the engine lathe, or from changing feeds and speeds in the turret lathe. While the latter machine is dependent upon one spindle to meet all the conditions of cutting and boring, the high production machine performs each operation under separate spindles, each of which has independently more changes of speeds and feeds than are found in the modern geared-head engine lathe.

Comparative Costs on a High-Production Job

	Former Method	Present Method
First cost of machines	$19,075	$12,000
First cost of tool equipment	3,640	575
First cost of transmission and power equipment	1,575	375
Shop floor space occupied, sq.ft.	576	35
Power required, hp.	30	15
Labor hours required for annual production	27,000	5,400
Interest on investment @ 6 per cent	$1,457.40	$797.00
Depreciation @ 10 per cent	2,429.00	1,295.00
Replacement of tools and maintenance, one year	1,700.30	906.50
Rent of floor space @ 30c. per sq.ft.	172.80	10.50
Power charge @ $0.02 per kw.-hr.	1,204.20	604.80
Labor charge	25,063.15	7,292.55
Total production in year, pcs.	79,800	81,000
Final cost per piece	$0.314	$0.09

A cost comparison was made over a period of a year on the production of motor end-shields by the "concentrated-production" method of a modern high-production machine as compared with lathes and turret machines. An analysis of the results, given in the accompanying table, makes an interesting study from the standpoint of proper selection of machines to fit the job. For this particular piece of work not only were space and overhead reduced, but the labor required was cut to one-fifth, and the total cost per piece was cut down from approximately 31 cents to 9 cents. With the present method of machining the piece only one high-production machine is employed to obtain the required production, while formerly 8 turret lathes, 4 engine lathes, and one arbor press were engaged continuously on the work.

The machining of duplicate turned or drilled parts on the high-production machine is a recognized advanced stage in the progress of duplicate manufacture, and is also a stage in the evolution of the machine tool to meet the demands of competitive quantity production. That it is recognized is illustrated by the fact that one plant producing low priced cars has more than 400 of this type of high-production machine in operation on duplicate automobile parts.

It is not claimed that this type of machine is most economical at all times. The progressive maker of a modern high-production machine keeps an engineering staff for the express purpose of advising the production manufacturer on his plant layout work for each job. His foremost claim is that the selection of the proper machine for a given job has become more than ever before a technical and a management problem, and where continuous production under highly competitive conditions is demanded, all aspects of the case must be studied in advance to assure ultimate economy.

Oxy-Acetylene Welding of High-Carbon and High-Speed Tool Steel

By George L. Walker
Associate Research Engineeer, Air Reduction Sales Co.

THE WELDING of high-carbon tool steel and high-speed steel has an extensive field for development and there is need for further study and development in methods and materials before these steels are as successfully and as extensively welded as is low-carbon steel. It is quite difficult to give a hard and fast rule for welding high-speed steels that will meet every demand. The piece that is to be welded, its design, and the purpose for which it is to be used, as well as the chemical characteristics of the metal within the zone of welding have an important influence on the welding procedure. The experience of the welder also must be considered. There are, however, some rules to be observed in welding these steels that are almost fundamental and that must be followed if any degree of success is to be realized.

In the welding of tool steel the carbon content is an important factor to consider. A steel with a carbon content of from 0.60 to 0.85 per cent may be welded fairly easily with ordinary care. With a carbon content of from 0.85 to 1.00 per cent the welding is more difficult, and with 1.00 to 1.50 per cent carbon a degree of care that can only be attained by experience in welding such steel is necessary, but both high-carbon tool steel and high-speed steel have been and are now being welded successfully. Much has been accomplished in reclamation and general repair work, such as building up the faces of hammers and wrenches, and reclaiming milling cutters, reamers, and form tools with broken teeth, by building up the worn part with high-speed and tool steel and regrinding to shape. Lathe tools for use in heavy cutting are being made by welding a high-speed steel bit to a medium carbon shank, as in Fig. 1. Gasoline engine valves are made by welding low-chrome steel stems to high-speed steel heads. Parts of machinery that require a hard, erosion-resisting surface are also built up in this manner. Stelliting is accomplished by practically the same methods.

One of the main requisites in welding high carbon and high-speed steel is the proper torch and tip. Their construction should assure a good mixing of the gases before burning and a low gas ratio. The flame adjustment is important. It should be a reducing flame for high-speed steel, stellite, and the higher carbon steel. With the carbon steels this flame adjustment depends somewhat upon the carbon content. Low-carbon tool steels may be welded with a neutral flame that

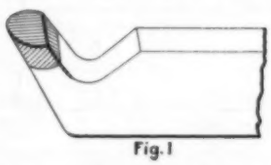


Fig. 1

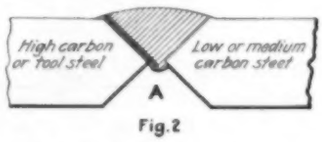


Fig. 2

Fig. 1—Lathe tool built up with high-speed steel. Fig. 2—Metal and oxide extruded through the V. Note also layer of filler material deposited on the high-speed steel

should be non-oxidizing, while high-carbon steels require an excess of acetylene in the welding flame. It is difficult to describe the exact flame characteristic, and only experience can tell the welder the flame desired.

The welding rod is important also. For welding high-carbon steel it should be of high-grade material and not lower in carbon content than the steel to be welded. If the welding metal is to become a part of the cutting edge it is preferable that the steel contain a slightly higher carbon content. Any great departure in the carbon content from that in the steel to be welded will make the welded metal either too soft or too brittle. On the other hand there are many welds that can be made

Abstract from the paper presented before the New York Section, American Welding Society, May 18, 1926.

in tool steel at a point remote from the cutting edge where a much lower carbon steel can be used.

In preparation of the part to be welded a rather wide bevel on tool steel is preferable. This will make unnecessary the fusing down of the sides in making the weld. All parts to be welded should be carefully cleaned of dirt and dust.

The welding of high-speed steel requires the same method of preparation as for high-carbon tool steel and a welding rod that will flow freely and not cause blowholes should be used. Heavy oxides from the chromium and tungsten present in high-speed steel usually form on the surface in the melting operation, and blowholes form that are difficult to eliminate. It will be found advantageous to use a high-speed steel filler rod containing vanadium and cobalt. These steels flow freely and cleanly, and hence are desirable for welding.

The torch tip for welding all tool steels should be two or even more sizes smaller than should be used for the average steel of the same dimensions. This, however, is controlled somewhat by the nature of the weld and the skill of the operator. A flux is necessary in order to make good sound welds in tool steel. A good cast-iron flux will give good results on carbon tool steel. There are fluxes on the market, however, that have been developed for tool steel.

In welding tool steel care should be taken not to overheat the welded metal. Also the welded metal should not be worked unnecessarily. Deposit the filler rod in thin layers and add the metal just fast enough to prevent it from flowing over where the base is not in a weldable condition. Continue in this manner until the weld is completed. Frequent re-working of the weld metal causes most of the defective welds. It causes blowholes and creates an excessive film of oxide that collects on the surface. The success of the weld depends upon the proper addition of the filler rod.

When the welded joint is of the double-V type, some metal will extend through the bottom of the V when

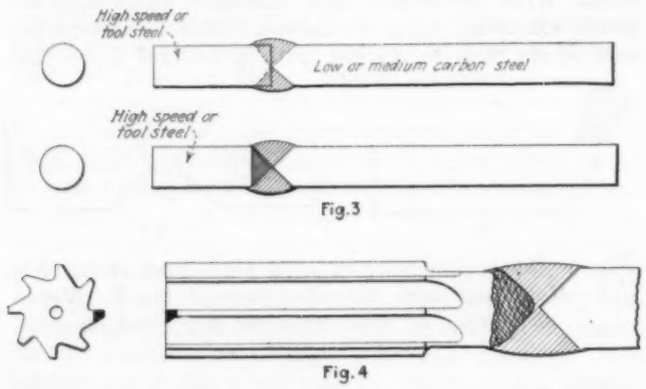


Fig. 3—Welding by means of a cone previously built up on the high-speed steel. Fig. 4—Building up teeth on end of reamer and welding broken shank

the first half of the weld is completed, Fig. 2. This extended metal is composed in great part of oxides, and it should be removed before starting the second half of the weld in order to prevent an accumulation of oxide in the weld.

High-speed steel should not be melted down in making a weld but rather the filler rod should be added to the surface, Fig. 2, taking care, of course, that the surface is in the proper state of fusion to take a weld. For this reason a wide bevel is of great advantage. The combined V should not be less than 90 degrees.

Where a carbon tool steel or high-speed steel bit is welded to a medium-carbon steel shank or base and it

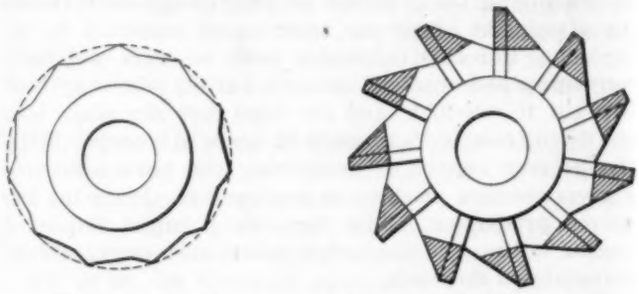


Fig. 5—Building up teeth on a milling cutter

is not desirable or practicable to bevel the bit, it is best to prepare the bit first by building up over the surface a conical or beveled section with the filler rod, Fig. 3. The filler rod preferably should be of nickel or vanadium steel in a weld of this type. The bit is then placed in position on the shank or base and the same filler rod used to complete the weld. This type of weld is used successfully on special reamers, Fig. 4, heavy lathe and shaper tools, and so forth.

Lathe tools of the forged carbon tool steel type have been modified by building up the cutting ends with high-speed steel along the lines shown in Fig. 1. Milling cutters, Fig. 5, have not only been repaired by building up broken teeth, but new cutters have been made by using a low-chrome steel center and building up the teeth with the oxy-acetylene flame. As an aid in this work a form or mold was made of graphite, approximating the shape of the teeth. The cutter base was mounted on a shaft or arbor so that it could be turned readily. The form was held in place and the weld made by carefully fusing the base and then filling up the form. These cutters were made in very short time and were highly successful. The filler rod was a cobalt high-speed steel. No heat-treatment was required after welding. The cutter was ground into shape and then put in service. In a test it showed greater efficiency than similar cutters made from cast or forged high-speed steel.

Carbon tool steels after welding must be heat-treated by hardening and tempering. A tool after welding requires to be normalized or annealed by cooling slowly before it is re-tempered. Hammering of the weld after completion must be done with caution. It is beneficial to a weld in carbon tool steel where the parts welded together and the filler rod are of the same composition, but where the parts, including the deposited metal, differ in carbon content or other constituents hammering should not be attempted, as the joint may break apart due to the difference in malleability of the metals. Many failures in welding these steels can be attributed to hammering the weld.

When does sheet metal become "plate"? Some manufacturers consider all below ¼ in. as sheet, and all above as plate. During the war the manufacturers agreed to designate gage No. 5 (0.2188 in.) and all below, as sheets, while all sheets thicker than No. 5 were to be designated as plates.

"Blowing" a Shell of Heavy Sheet Steel

By Ellsworth Sheldon
New England Editor, *American Machinist*

Making a shell to replace a casting—Metal is three-sixteenths thick—Tallow is used as the expanding medium—Tools are quite simple

THE OBJECT to be seen at the right of the row of shells in Fig. 1 is used in large quantities by manufacturers of textile machinery. Until the process here described was worked out the part had been made of cast iron, and, as it was necessary to machine the castings both inside and out, production was slow and costs excessive when compared with the new method. Made from sheet steel under drawing presses, no machining is required; the completed piece is ready to be polished as it drops from the press after the final operation.

The tools for producing the steel part were designed by H. G. Carlson, superintendent of the Rockwood Sprinkler Co. of Worcester, Mass., and the part is made in the factory of that company. The material of which it is made is 0.187-in. hot-rolled strip steel. The first cup, as shown at the left of the row in Fig. 1, is made in the double-action press, Fig. 2, and a similar press is used for the blowing operation. Single-acting presses are used for the two intermediate drawing and forming operations and to pierce the small hole in the end of the shell, which is the final stage in its production.

Parts *A*, *B* and *C* in Fig. 3 are, respectively, the blanking punch, the drawing punch, and the combined blanking and drawing die to produce the cup. The punch *D*, die *E* and knockout *F* are required to produce the shell in its third stage. The tools for the second stage do not differ from those of the third except in size; both are combined drawing and swaging operations.

Parts *G*, *H H*, *I* and *J* are the tools that bring about the final transformation by the "blowing" method. At *K* may be seen the die and punch for piercing the small hole in the closed end of the shell after the forming

Fig. 1—Shell made by the "blowing" method

operation. Part *L* is a small ladle that is made from a convenient shell by providing it with a handle of twisted wire. It plays a very important part in the forming operation.

The first, second and third operations need little explanation. A blank is cut from the strip of stock with the punch *A*, which is held in the blankholder slide of the press, is immediately pushed through the die *C* by the punch *B* to form the flat blank into the cup, and the latter is stripped from the punch below the die as the punch is withdrawn.

The second and third operations reduce the diameter of a part of the shell successively by pushing it into a die that is made to conform to the desired outer con-

Fig. 2—The blank and draw press in which the cups are made

tour. The punch is made to fit the inner contour, so that when the tools come together with the shell between them, the bell-shaped part of the shell is formed by swaging. Not only are powerful presses required for these operations, but the shells must be well annealed each time.

The fourth operation is accomplished by the method variously called "swelling," "blowing," or "expanding"; sometimes using oil or water to communicate the pressure to all otherwise inaccessible parts of the shell, but oftener with a ball of soft rubber attached to the punch or dropped loosely in the shell. In this case, because of the very heavy stock used, the pressure transmitting medium is cold tallow—at least it is cold when the press strikes the work.

This final transformation is a two-man job; a press operator and a helper. The helper is provided with several boards of convenient length, in each of which a row of holes is bored into which the shells may be placed to hold them upright with the open end at the top. On a convenient bench there is a receptacle fitted with a gas burner to melt the tallow. It is the helper's job to

keep the press operator supplied with shells that have been partly filled with tallow.

Though the tallow is handled by the helper in the molten state, there are enough of the boards so that when the operator reaches for a shell the tallow has had time to set. Two even fillings of the little ladle give the right quantity; the shell of which the ladle is made having been carefully trimmed to insure its correctness in this respect. Too little tallow would result in an incompletely formed shell and too much might cause serious damage to the tools—at least it would be very unpleasant for anybody that happened to be in the vicinity of the press.

At the bottom of the recess in the die *G* there is a button, or plug, of hardened steel shaped exactly to fit the bell-portion of the shell. When a tallow-filled shell is inverted over this button (there is a shell in position in Fig. 3) there is no empty space inside of it; all of the space that is not occupied by the button is filled with tallow.

The two half-dies *H H* are next set into the die bed, the wire handles by which the operator manipulates

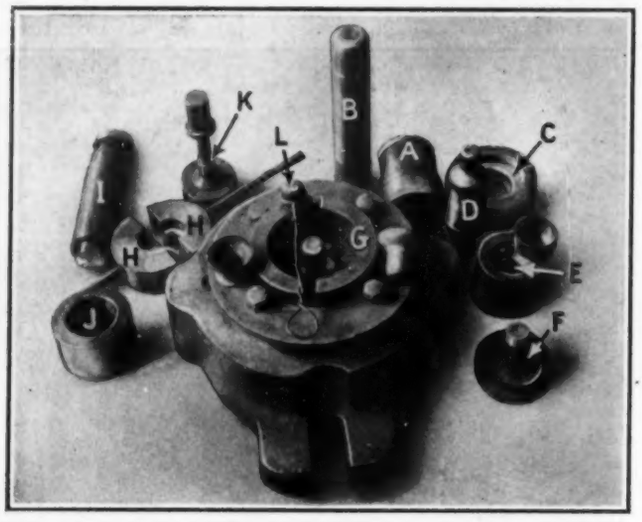


Fig. 3—Tools for first, third, fourth and fifth operations

them dropping into the slots that may be seen in the upper edge of the steel re-enforcing ring. Four sliding pins in the bottom of the die are actuated by the knock-out bar of the press to lift the half-dies and the contained shell out of the reinforcing ring after the blow has been struck.

Part *I* is the punch by which the pressure is applied. Part *J* is held in the blankholder slide of the double-action press, and as it comes down ahead of the punch it rests upon the surface of the half-dies *H H*, forcing them to a seat in the reinforcing ring and at the same time causing the bell-shaped shell to be pressed tightly against the steel button in the bottom of the die. The bore of the steel reinforcing ring is slightly tapered, and the periphery of the combined half-dies is tapered to correspond, so that all parts are held together very tightly.

Thus, it will be seen, the shell is entirely inclosed within the steel walls of a chamber that is shaped to the desired contour that the shell will take after this operation. The tallow inside cannot get out, therefore it is merely a case of stepping on the top of the shell—the only exposed surface—hard enough to flow the metal. Shells before and after the operation may be seen on the die.

Though it was a matter of long experiment to get all of these conditions just right, once they are learned the work is not at all difficult. The job is carried forward with ease and certainty, and the loss from incompletely formed pieces, the only way in which loss can occur, is so low as to be negligible.

Exasperating Jobs—Discussion

By Harry Senior

I WONDER if all the engineers and draftsmen who have to do with the designing of machinery that makes exasperating jobs for machinists, such as the one complained of by "Jim" in Entropy's article on page 10, Vol. 65, of the *American Machinist*, are without shop experience? Sometimes I think the men who have been "through the mill" are the worst offenders of the lot.

I once worked as experimental machinist and toolmaker for a man who designed—or at least originated—practically all of the special machinery for a large manufacturing company for use on its product. This man had entered the employ of that company as apprentice in the machine room when he was a boy of 14 years, and had never worked elsewhere. In his early days there were no automatic machines as we know them now; everything was done by what we would now call "hand" operations.

His education was self-acquired; his college the shop; his tutors the men for and with whom he worked; his text-books the work going on about him. When I knew him he was a hoary-headed old man who came and went at his pleasure and whose office was a corner of the machine room, where he worked out his schemes on a drawing board up-tilted on the end of the bench, or personally assisted in reducing his visions to concrete realities on lathe, shaper or milling machine. He was a substantial stockholder in the company and drew a salary that was said to rival that of the president.

His machines were marvels of ingenuity, one of them often doing the work that had required the services of a dozen operatives. They rarely required the attention of a machinist after they had once gone into operation, but when they *did* demand repairs they were the despair of the men who had to do the work.

This man's hobby was compactness. With all the room in the world to spread his mechanisms, he delighted in putting two things in the place where but one should go. I have often heard the machinists say that to get at a recalcitrant part of one of those machines, no matter what or where located, it was necessary first to remove every other part of the machine.

This man surely could not have been accused of being without mechanical experience. He possessed it in a degree rarely attained by engineers who have been educated along modern lines, yet he most certainly could conceive some of the most awkward and exasperating jobs of machining that were ever my fortune to behold. Whenever I work on my car I am inclined to believe that many of the designers of our modern automobile engines were descended from him.

In the day that Entropy suggests, when we have "boards" to license our designers and draftsmen, where are we going to get our examiners?

Automotive Production

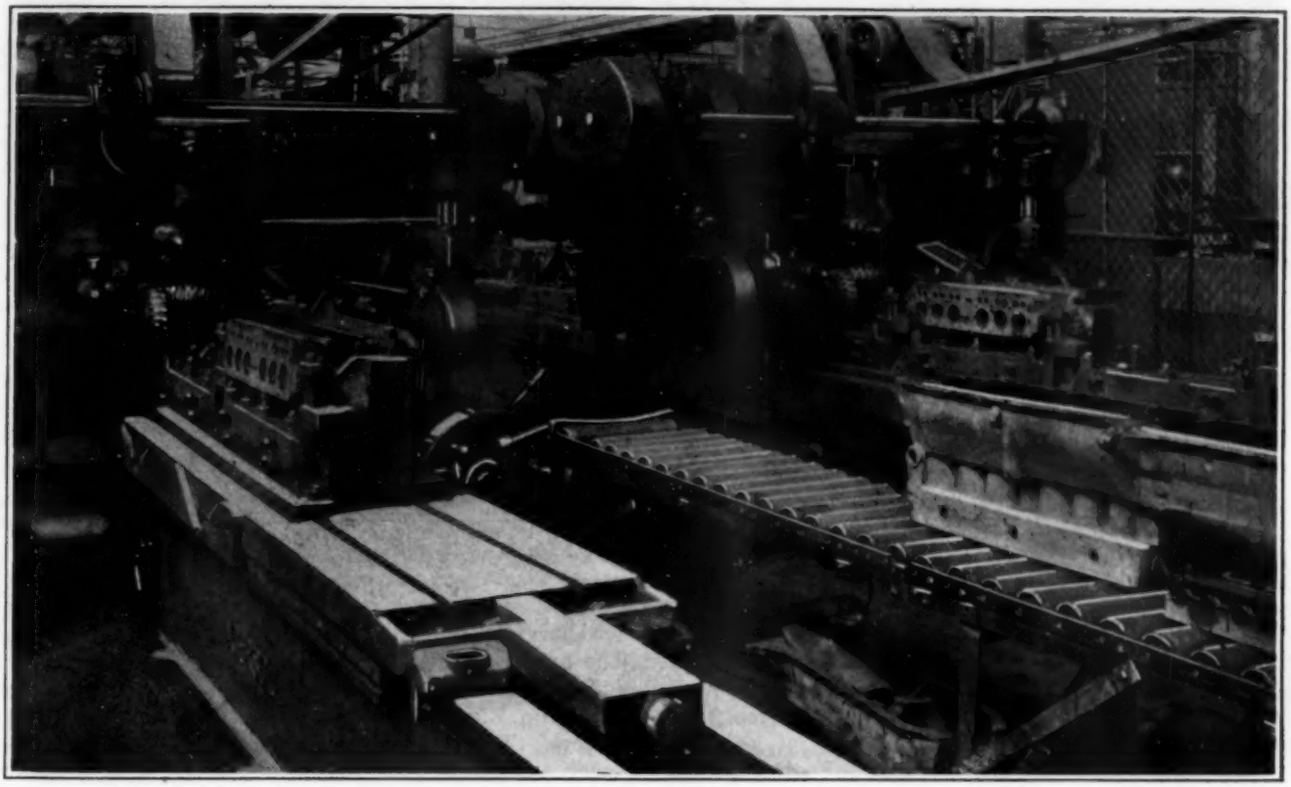


Fig. 1—Milling the cylinder blocks

How Production Methods Vary in Shops Building "Light Sixes"

By Fred H. Colvin
Editor, *American Machinist*

Operations on cylinder blocks and heads for the Overland "Light Six"—Milling machine with tilting table—Thirty-three holes drilled at one setting

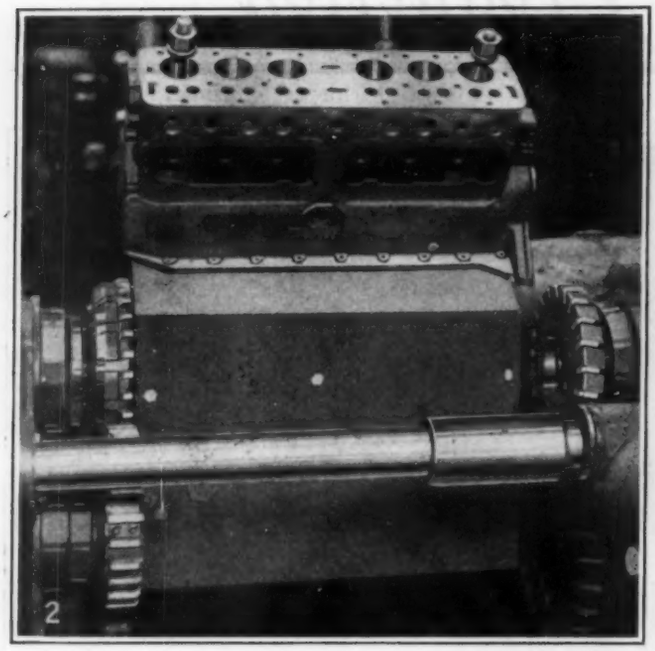
WHILE automobile-engine building has been very largely standardized, there are still many differences due to design, shop equipment and individual ideas of the production engineers. The first step in building the Overland 6-cylinder engine is to paint the inside of the crankcase that forms the lower part of the cylinder block. Painting makes the block more pleasant to handle and ties down any small loose particles on the surface.

First, three locating spots are milled, their location being shown in Fig. 3. The top, the bottom, the manifold face and the faces or seats for the bearing caps are next milled, the operation being shown in Fig. 1. The conveyor line is between the two Ingersoll milling machines, both of which are at work on the same operation. The construction of the fixtures is also shown in this view, the block resting on the three locating points milled, and being further supported by jacks to prevent distortion under the thrust of the cutter. The cutters that machine the bearing-cap seats are on the other side of the machine housing and are consequently not visible.

The holes in the bottom of the crankcase are then

The third article. The fourth will appear in an early issue.

Automotive Production



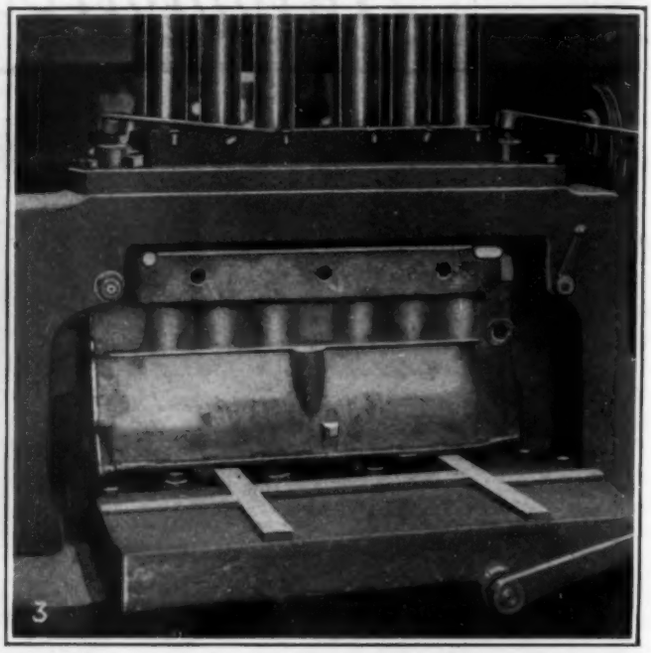


Fig. 2—Facing the ends on a rotary machine. *Fig. 3—The cylinder boring fixture*

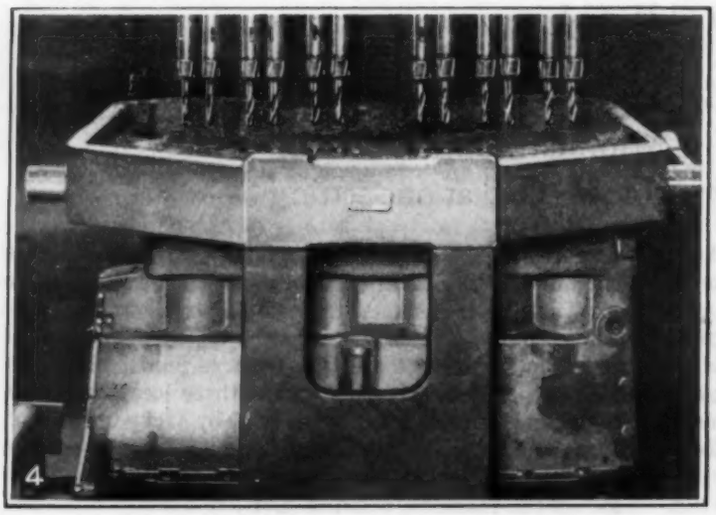
drilled, including those for the bearing caps, and two of the holes in the flange are reamed to serve as locating holes in the operations that follow. Continuous milling of the ends follows on an Ingersoll rotary machine, as in Fig. 2. It will be noted that different types of cutters are used in this operation.

Boring the cylinders is done on a Foote-Burt machine as in Fig. 3, which also shows the three locating spots milled in the first operation. There is nothing unusual in either the fixtures or the tools. The roughing cut takes out about ¼ in., leaving the cylinders about 2.85 in. in diameter. The next cut enlarges the bores to 2.965 in., while the two reaming operations leave them 2.9885 and 2.9995 in. respectively, the final 0.0005 in. being left for the honing operation.

The rough boring is done at 37 r.p.m., the second cut being taken at about double that speed. The roughing feed is $\frac{1}{32}$ in. and the second cut $\frac{1}{16}$ in. per revolution. The hone runs at about 60 r.p.m. and is of 120 grit.

Valve-guide holes and valve seats are bored in the fixture in Fig. 4, using combined drills and roughing cutters. The machine is in line with the roller conveyor, the rollers being below the fixture, so as to make it easy to handle the cylinder block. Location is secured by the reamed bolt holes in the flange as in other operations.

The oil-filler and oil-indicator holes are drilled in the fixture in Fig. 5. With the table *A* in a horizontal position the cylinder block slides over the ways on each side and is located by the usual dowels. With the table still in the horizontal position the arm *B* is over the oil-filler opening and the hole is bored by the tools



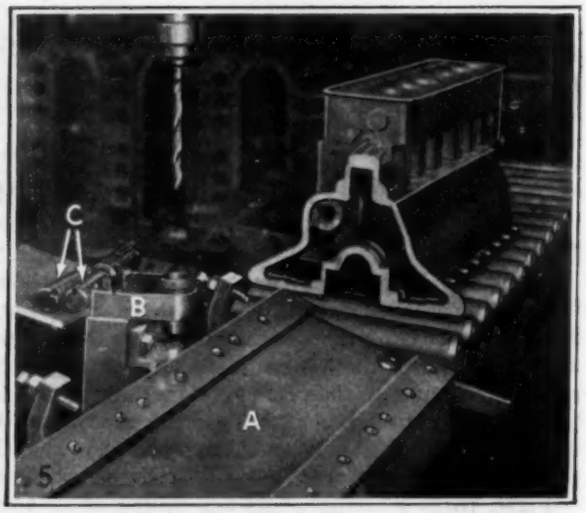


Fig. 4—Drilling valve-guide holes and seat openings. *Fig. 5—Double-operation drilling fixture*

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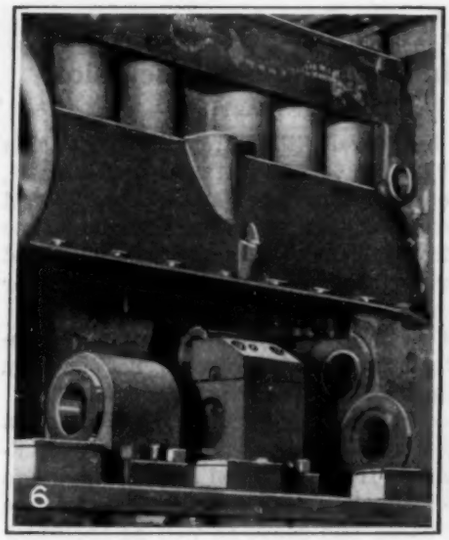


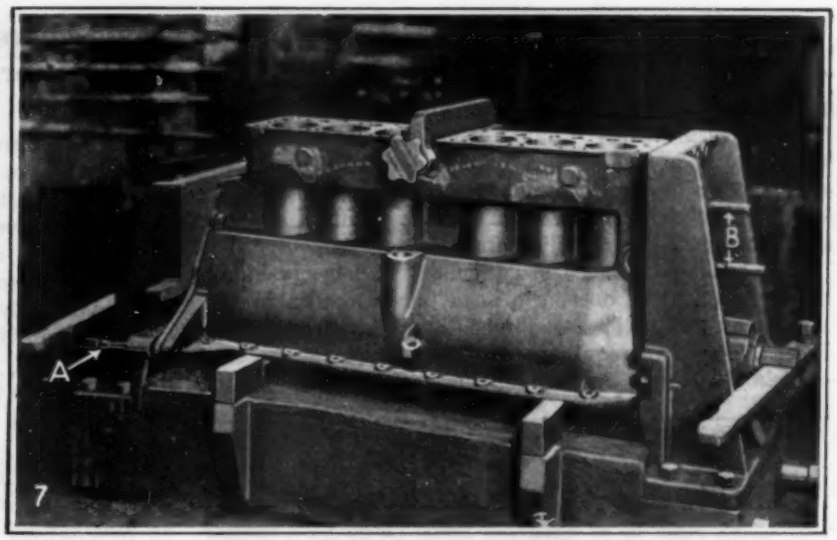


Fig. 6—Fixture for boring shaft holes. *Fig. 7—Test stand for cylinder block*

shown at *C*. Tilting the table into the position shown in Fig. 5, brings the pad through which the oil-indicator hole is drilled into position under the bushing in the arm *B*. The oil-gage, or indicating-rod hole is then drilled and faced, and the block passes on to the conveyor on the other side.

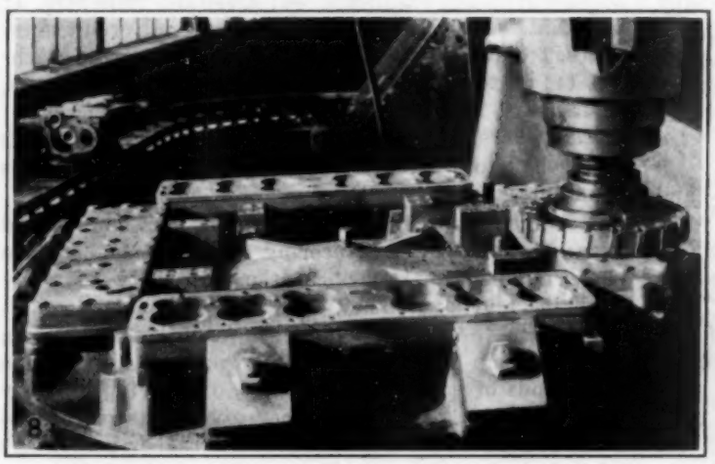
After an inspection, the bearing caps are put in place and the crankshaft and camshaft holes are both bored as in Fig. 6. This view gives a good idea of the type of the fixture with its massive supports and heavy yoke across the top. It also shows the rigid supports for the boring bars, that prevent them from springing and insure their proper alignment. The block is slid on the table from a conveyor and raised into position for boring.

One of the gaging fixtures in which the main dimensions are checked, is shown in Fig. 7. The movable end-plungers align the bore of the end bearings with the camshaft bearings. Other holes are checked as by the gage pin at *A*. Gages at *B* check the location of the holes for the attachment of the water pump and the fan bracket, the same plugs being used through a number of bushings for checking other holes, as shown above their present location.

The design of the cylinder head permits easy machining. There is no projecting water connection, the hose outlet being secured by attaching an angular elbow at the front end. On account of the absence of a water connection, both the top and the bottom of the head can be machined, as in Fig. 8, at one pass of the milling cutter.

The fixtures are arranged to hold four heads, two in each position, so they can be milled at the same time on an Ingersoll rotary machine. One revolution of the machine table gives two complete cylinder heads, the same cutter milling the faces, or undersides of two heads, and the bolt bosses and water-outlet surfaces on the tops of two others. The water-outlet holes are cored in the water jacket. The clamping jaws have serrated teeth for firmly gripping the work, while stop pins take the end thrust of the cutters.

All the holes in the head are drilled at one setting in the Natco machine in Fig. 9. The guide plate with its bushings travels with the drilling head and is guided



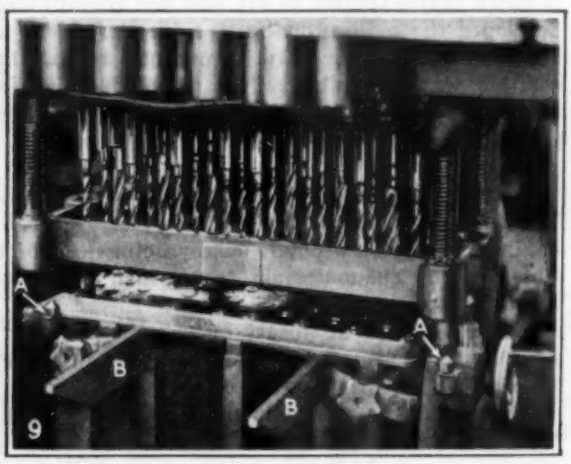


Fig. 8—Milling cylinder heads. *Fig. 9—Drilling 33 holes in head*

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by long pillars at each side, while the shorter dowels, as *A*, give additional insurance of correct alignment. The special head drills all the bolt holes, the six spark-plug holes, and the holes for the water-connection elbow. The projecting arms *B*, make it easy to put a cover on them and slide the head in place under the drills. The raised edge of the bushing plate retains the coolant, keeping the drills flooded during the drilling. There are thirty-three holes drilled in this operation.

The spark-plug holes are then counterbored and all six are tapped at once, the head being located in the simple fixture in Fig. 10, by dowels that fit two bolt holes. The head requires very little clamping, the two end clamps simply keeping it from shifting its position.

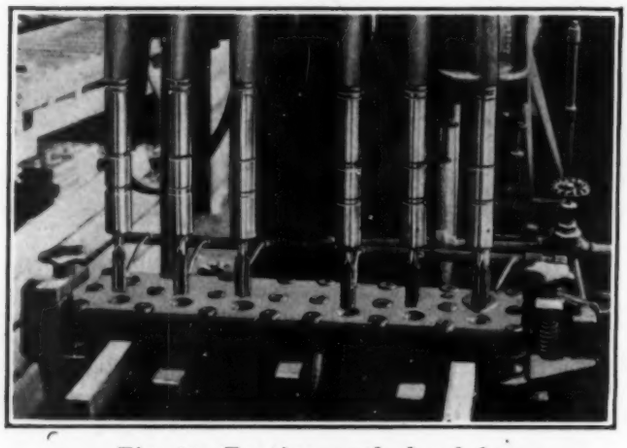


Fig. 10—Tapping spark-plug holes

The two holes for the water outlet are tapped separately. After a thorough washing to remove the grease, the head is water tested, inspected, and is then ready for assembly.

Erratum

In an abstract, published on page 854, Vol. 64, of an address by Arthur C. Pletz before the Cincinnati Section of the A.S.M.E., the statement was made that the Ford Motor Co. developed the mult-au-matic in conjunction with the Bullard Machine Tool Co. It would be more nearly correct to say that the Bullard company developed the mult-au-matic to solve a problem of economical and accurate quantity production, and that the solution was admirably suited to the requirements of the Ford people. It was also installed by other customers, but Ford is probably the largest user.

Fabroil silent tappet adjusting screws for L- and T-head engines, and Textoil silencers for overhead valve engines have been brought out by John C. Hoof & Co., Chicago, Ill. The materials from which the devices are made are products of the General Electric Co. The screw consists of an insert of spinnable cotton fibers standing on end and highly compressed in the cupped head of the adjusting screw.

The silencer is placed in position on the valve stem with the rocker arm resting on it. The top of the silencer is so fashioned as to act as an oil cup while the bottom is in the form of a valve stem seat.

Is There Anything the Matter with Engineering Education—Discussion

By G. B. Stuart

While I agree in general with Entropy's views on this subject on page 972, Vol. 64, of the *American Machinist*, I believe that too many engineers are inclined to feel that the engineering student should not spend any time on studies not directly connected with engineering and that the engineering graduate is something like a traitor if he eventually decides to change to something else.

In my opinion the engineer himself is largely responsible for the fact that engineering is not publicly considered like the medical or legal professions.

The medical colleges of the country now demand a college degree before the student enters on the specialized medical studies. If a mechanical engineer wants to become a big executive in a manufacturing plant where he will handle finance and sales, as well as encounter daily the trained executives of other plants, he needs the broader studies of the academic college.

A number of the engineering colleges do give broader courses for the first four years, only giving an engineering degree after two years post-graduate work plus a year of experience. But many others give degrees in the ordinary term of four years. I do not mean to say that the graduate of the latter type of engineering college is not fitted to become a higher executive. In fact, plenty of men get to the top without any college training at all. But, everything else being equal, it ought to be easier for the engineer with the broader education to perform the duties of an executive.

To show the value of an engineering education it would be difficult to cite a better example than the statistics of one of the classes of an old New England engineering college, returning this year for reunion after 15 years. This school gives no engineering degrees without two years post-graduate work. Here is the present status of 238 engineering students 15 years after graduation: Owners or partners, 22; presidents, 20; vice-presidents, 22; secretaries and treasurers, 10; general managers, 16; sales managers, 8; assistant sales managers, 3; district managers, 6; purchasing agents, 2; salesmen, 26; engineers, 36; assistant managers, 1; assistant treasurers, 2; superintendents, 3; credit managers, 1; advertising managers, 2; professors and teachers, 11; writers, 3; lawyers, 6; clergymen, 1; physicians, 5; farmers, 9; foresters, 4; army and navy officers, 4; stock brokers, 4; auctioneers, 1; bank cashiers, 1; building contractors, 2; chemists and metallurgists, 5; accountants, two.

Not more than five per cent of the men enumerated ever got their final engineering degree, and about the same number went back to the university to study medicine and law. They apparently got enough engineering in the regular course, however, to start them right. In my estimation it will do no harm to continue both kinds of engineering colleges, one having a highly specialized course and the other giving the more "liberal" course, but it is likely that the higher percentage of technical engineers will be drawn from the former schools, while the executives will come from the others.

Standardization of Plain Round Steel Punched Washers

By O. B. Zimmerman
International Harvester Co., Chicago, Ill.

An analysis of the requirements of all the principal industries indicates that nine series of washer proportions are necessary—Tentative standards proposed for the purpose of stimulating discussion

NO SIMPLER machine element exists than the common round steel washer with either a square or a round hole in it. It has only three variable dimensions: Outside diameter, inside diameter (or side of square), and thickness. Yet even with this extreme simplicity, an analysis of the amazing number of existing combinations of dimensions used in practice clearly shows that no comprehensive attempt has ever been made to standardize on washer sizes that will meet the requirements of all the principal industries. In the belief that such a standardization not only is possible but also is of real advantage to all concerned, the International Harvester Co. has devoted considerable attention to this subject and the results are published below as tentative standards for criticism and discussion.

Washer manufacturers of the United States adopted and now work to a list known as that of January 10, 1910. This list was a step in the right direction, but unfortunately it covered only one series that was not adequate for general needs. The present proposed standards take into consideration the typical washer requirements encountered in the construction of automobiles, airplanes, machine tools, agricultural implements, wood products, and other equipment such as is special to the railroads and the army and navy. An attempt has been made to establish a sensible and logical scheme that will satisfy the maximum number of requirements.

The first step was to analyze the washer requirements of various industries. Over sixty varieties of machinery that consumed 800 tons of washers a year were studied. Specifications called for over eleven hundred different sizes—a number all out of proportion to present necessity. It was found that the largest consumption of washers occurred with hole sizes ranging between $\frac{5}{16}$ and $1\frac{5}{16}$ in. and with outside diameters ranging from $\frac{1}{2}$ to 3 in. Hence these sizes have been considered chiefly in the proposed standards. Fig. 1 shows the dispersion of sizes for those washers used in excess of 100,000 in the year 1919. An even wider variation would be indicated if all washers were shown. The full line passes through points of the Manufacturer's Standards of Jan. 10, 1910, also known as the U. S. Standard washers. It is evident that the field of required sizes is largely outside of the Manufacturers' Standards. Fig. 2 is similar to Fig. 1 except that it covers the larger sizes. In both cases no consideration was given to washer thickness and the only factor examined was the relation of inside to outside diameter.

In general, the points in Figs. 1 and 2 scattered above the Manufacturers' Standard line indicate washers proportioned for metal to metal contact where the materials can resist the crushing down of the surfaces up to the strength of the bolt, while the points scattered

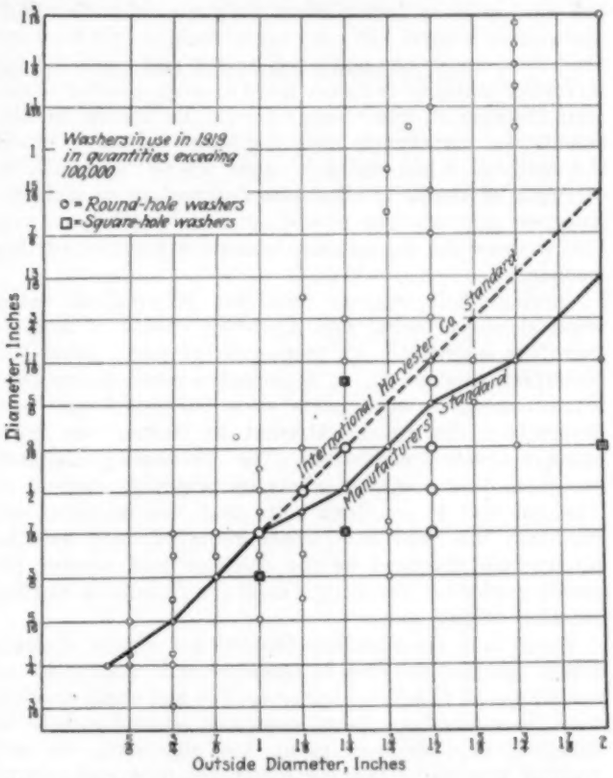

Washers in use in 1919 in quantities exceeding 100,000
o = Round-hole washers
□ = Square-hole washers
International Harvester Co. Standard
Manufacturers' Standard
Diameter, Inches
Outside Diameter, Inches

Fig. 1—Dispersion of washer sizes in use in 1919 in quantities over 100,000

below this line indicate washers for use with softer materials such as hard and soft woods, rubber, vulcanized fibre, and the like.

It is evident that no single standard could satisfy all requirements and that several distinct series are necessary. Washers in general are divided into machine bolt, carriage bolt, recess, pin, boss, rivet and wood washers. Many washers can serve more than one group,

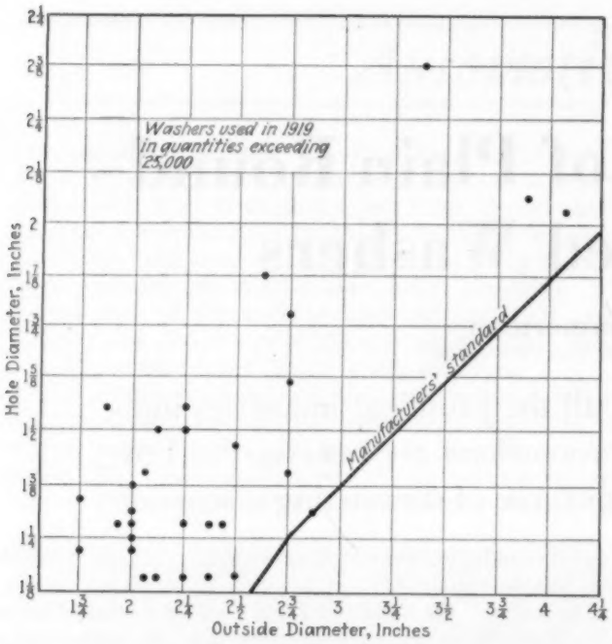


Fig. 2—Dispersion of large washer sizes in use in 1919 in quantities in excess of 25,000

the chief guiding factor being the material with which the washer is used. For instance machine bolt washers are placed under the bolt head or nut and since the intervening material is metal, wood or even a softer material, the size of the washer should be chosen to distribute the pressure in such a manner as not to crush the material when operated upon up to the crushing strength of the bolt; otherwise destruction or ultimate looseness occurs. The providing of a smooth hard surface to draw the nut against is another function of this washer.

Carriage bolt washers dominate in products using wood or sheet metal, and a correct choice of area is therefore essential. An inspection of parts using the Manufacturers' or U. S. Standard washer shows that many expensive wood parts show excessive wear and destruction due to the attempt to tighten the bolts against crushed material. The proposed standards recognize this economic waste by provision against it. The nut end of carriage bolts may use machine bolt washers; the head end, where required, may use the square-hole standard or the machine bolt washer depending whether the design calls for resistance against rotation or pull up.

There is a considerable demand for recess washers where internal bearing is essential and spacing in assembly is the chief requirement. Pin and shaft washers may be defined as those that are slipped closely or loosely over a shaft or pipe; they also serve the purpose of spacers or bearing plates for pins and cotters. Here again the fit in the hole is often important where protection against the ingress of dirt is needed. Another typical use is to provide a bearing for helical springs.

The following hole diameters will suffice for washers that are used behind cotters on steel pipe, where there is no pronounced cutting burr:

Nominal Pipe Size	Hole Diam.	Nominal Pipe Size	Hole Diam.
⅛ in.	7/16 in.	¾ in.	1 1/16 in.
¼ in.	9/16 in.	1 in.	1 5/16 in.
⅜ in.	¾ in.		

Boss washers are used to cover irregular or cored holes and originate from a desire to improve the appearance of an article. Bridging washers are also used to cover slots or larger holes than the body diameter of the tension member passing through them; special attention must be paid to their thickness. Rivet washers have a very close fit on the inside diameter. The mass of this type of rivet washer is below the range of sizes being discussed, but washers for rivets of ⅞ in. and larger are provided for in the proposed standards.

The old Manufacturers' or U. S. Standard is really a hardwood washer. Washers to take care of medium hard wood, medium soft wood and soft wood should also be provided. The so-called light washer was developed with the idea of saving material or weight over the U. S. standard, but if used on soft materials, the bolt can never be used up to its economic strength.

Instead, therefore, of a single standard, nine series of standards for round-hole washers are proposed and are presented graphically in Fig. 3. The last seven series are also applicable to square-hole washers. In Fig. 4 the relative proportions of each series is shown, the dimensions being based on a hole ½ in. in diameter. A composite view of all these washers superimposed upon one another is also shown in conjunction with a typical ½ in. square-head bolt and its hexagon equivalent, according to the new American Engineering Standards Committee proportions soon to be adopted for machine bolts, carriage bolts and screws. *A* and *B* are recess washers; *C*, pin; *D*, boss; *E*, light; *F*, U. S. Standard and hardwood; *G*, medium hardwood; *GX*, medium soft wood; and *H*, soft wood washers. In Fig. 3 the radiating lines denoting each series show the relation of the hole to the outside diameter and were selected as the best compromise after a careful study. The idea is to eliminate all washers whose proportions fall between these lines.

A designer must shift either the inside or the outside diameter into the nearest logical inch fraction and then select the other diameter to conform with one of the graded series as given by the radiating lines *A* to *H* inclusive.

Later it may be desirable to give attention to the naming or symbolizing of the types to indicate their

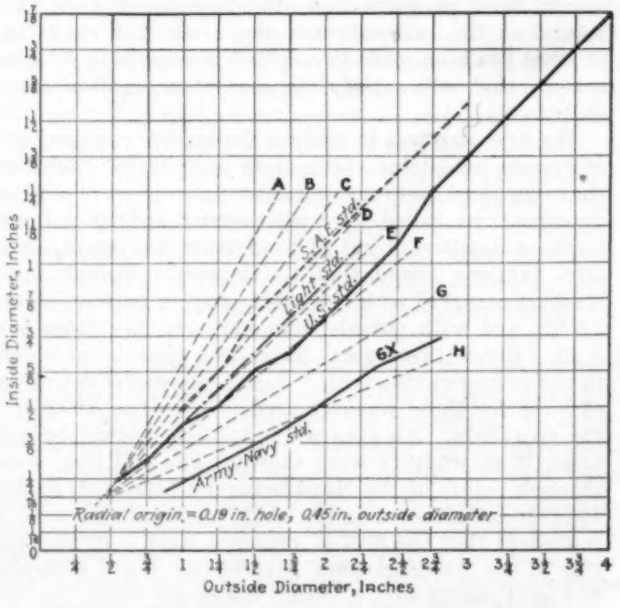


Fig. 3—Proposed series of washer standards

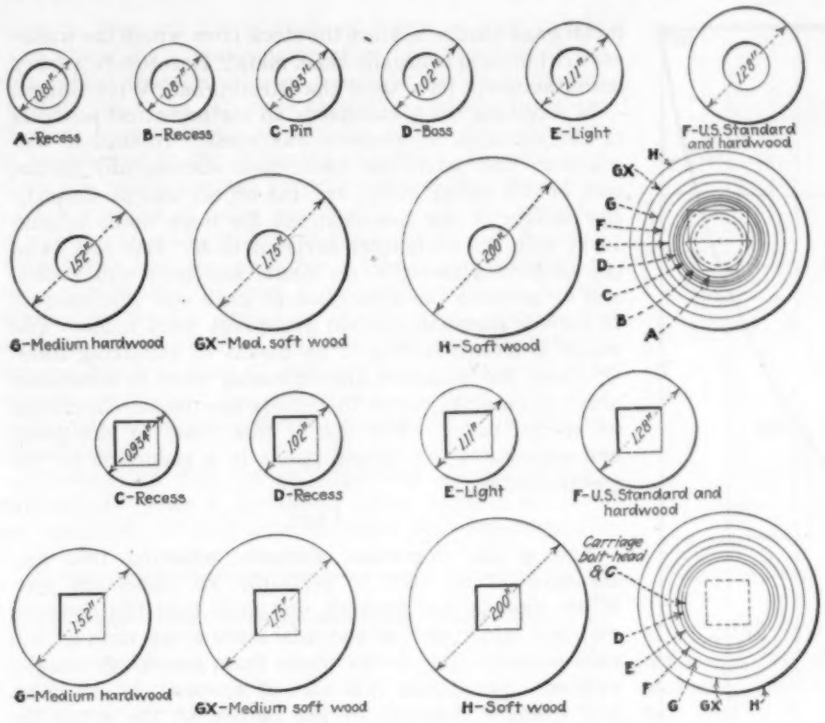


Fig. 4—Relative proportions of washers of the proposed series

proportions, but for purposes of discussion the designation by letters should suffice. For further comparison all existing washer standards are also included in Fig. 3. Since this figure is really only a graphical analysis, it is not a convenient form for actual use. In the accompanying Table I the same information is presented in tabulated form for round-hole washers. Table II is for square-hole washers.

The fundamental equation for the curves shown in Fig. 3 is as follows:

Outside diameter $= C$ (inside diameter $- 0.19$) $+ 0.45$.

When the inside diameter is 0.19 in. the outside diameter is 0.45 in. for any value of C; hence this relation establishes the origin for all the radiating lines. Values for the parameter C for each of the nine series of washers are plotted in Fig. 5. In applying these constants the final dimension chosen is modified to the nearest convenient fraction of an inch.

Table I—Tentative Standards for Round Punched Steel Washers with Round Holes

Machine Bolt Size	Carriage Bolt Size (Washer Under Head)	Rivet Size	Washer Hole Diam.	Outside Diameter A	B	C	D	E	F	G	H	Tol. on D and d +or—	Approx. U.S.S. Gage, No.
		5/16	11/64					1/2 R				.002	18 (3/64)
			7/32							9/16			
5/16			1/4			9/16		3/4			3/4	.003	18 (3/64)
		1/4	17/64					5/8 R					
			9/32				5/8			3/4	1 1/16		
1/4	5/16		5/16		5/8			3/4		7/8	1 1/16		16 (1/16)
		5/16	21/64					3/4					
			11/32				3/4		7/8		1 1/4		
5/16			3/8		11/16			7/8		1 1/16	1 1/4	.004	16 (1/16)
	1/4	3/8	13/32		3/4		7/8		1R	1 3/16	1 1/2		
3/8			7/16		3/4	7/8		1		1 1/8	1 1/2		14 (3/64)
		7/16	15/32		13/16		1		1 1/8 R	1 7/16	1 3/4		
7/16	5/16		1/2		7/8		1	1 1/8	1 1/2	1 1/2	2	.005	14 (3/64)
		1/2	17/32			1		1 1/4		1 1/8	2 1/8		
1/2			9/16		7/8		1 1/8	1 1/2		1 1/2	1 1/8 &2		12 (3/32)
	3/8	5/16	19/32		1			1 5/16		1 1/4	2 1/4		
9/16			5/8		1		1 5/16	1 1/8	1 1/8	1 1/8	2 1/8	.007	12 (3/32)
		3/8	21/32			1 1/4		1 1/2	1 1/2	2 1/8	2 1/2		
5/8	7/16		11/16	1		1 1/4		1 1/2	1 1/2	2	2 1/2		10 (1/8)
			3/4			1 5/16		1 1/8					
	1/2		23/32	1 1/8	1 1/2		1 1/2		1 7/8			.008	
3/4			13/16					1 1/2	2				10 (1/8) and
	9/16		27/32		1 1/8		1 3/4		2 1/4				
7/8	5/8		29/32		1 1/2		1 7/8	2 1/8	2 1/8				9 (3/32) and 8
	11/16		1 1/32	1 7/16		1 1/4	2		2 1/8			.010	
1			1 3/32	1 1/2		1 3/4	2 5/16		2 1/4				
	3/4		1 5/32		1 1/4	2	2 3/8	2 1/4					9 (3/32) and 8

NOTE: The tolerance on gage thickness is one even numbered gage smaller or larger, except when shown otherwise.

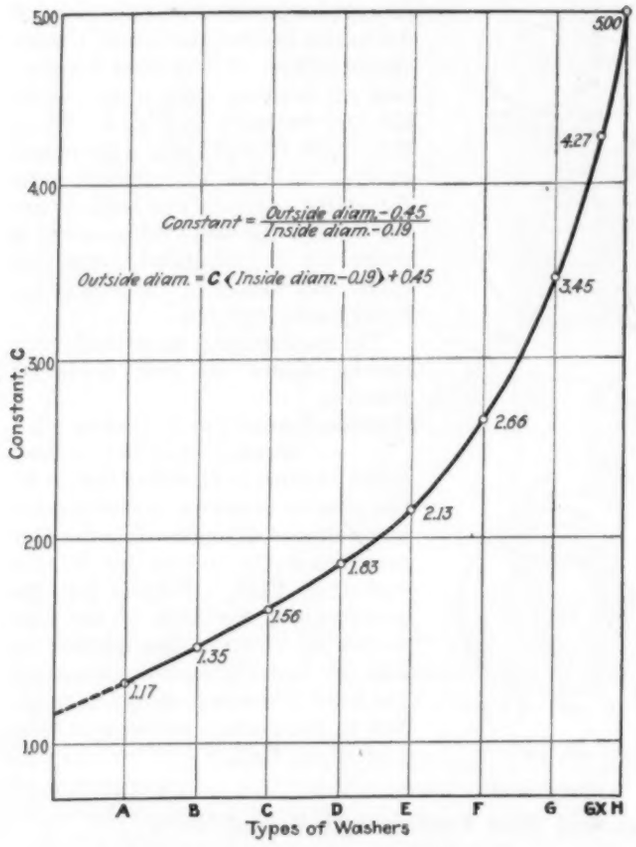


Fig. 5—Values of the constant C

In Fig. 6 the relation of the actual bearing area to the area of the hole for both round- and square-hole washers is plotted for each series of washers. The basic formula is given on the chart. The bearing pressure values for a few typical bolts are given in Table III. The figures are derived from a safe bolt load based on 50,000 lb. per sq.in. ultimate strength for steel and a factor of safety of 5. It is well known, however, how few times a bolt is safely loaded. More often in practice it sustains loads nearly up to its elastic limit, and hence the maximum washer bearing pressures, indicated in Table III, should be considered as subject to overload. For any crushable material it is well to anticipate bearing pressures ranging from the values corresponding to the safe bolt working load up to five times this load.

The analysis of washer production also showed that nineteen thicknesses were specified within the range of sizes being discussed. Practically there is little sense in holding strictly to a designated gage for fully ninety per cent of the cases. It seems possible, therefore, to satisfy general requirements with seven specified gages and to allow a tolerance of one even numbered gage above or below the standard unless this policy would jeopardize important design requirements. These proposed "standard" gage thicknesses are indicated in the extreme right column of Tables I and II in terms of U. S. Standard sheet metal gage numbers, since the stock from which the washers are punched is usually sheet metal. Heretofore washer manufacturers have used the Birmingham Wire Gauge.

In selecting these standards no mathematical analysis of the strength of washers was made. Instead it was assumed that what has been used successfully in the past is still satisfactory, and the object was to simplify the variety of the specifications for mass needs to conform with the designated series *A* to *H*. But just as in the case of diameters, no single standard will suffice, and by plotting the dispersion of gage size with respect to outside diameter certain groupings were made. The result is shown in Fig. 7 by means of radiating lines. Of these the standard approximates what is commonly noted in catalogs, while the others are usually furnished on special order. The use of this chart by designers and manufacturers should result in a reduction of odd specifications.

Cost

Among the important elements entering into any standardization, cost is certainly an important one. When considering washers, one finds that the material cost is a minor part of the total since scrap such as mill ends of sheet steel or the waste from punchings usually suffices. Sometimes this sort of economy is overdone. For example, because of the nature of the scrap the washers may be too small, and valuable wood products are ruined by crushing. On the other hand in large size

Table II—Tentative Standards for Round Punched Steel Washers with Square Holes

Carriage Bolt Size	Square Hole Size	Outside Diameter C	D	E	F	G	GX	H	Thickness U.S.S. Gage, No.
5/16	11/32				7/8			1 1/4	16
5/16	3/8	3/4			1				16
3/8	13/32					1 3/16		1 1/2	16
3/8	7/16	7/8		1		1 1/4	1 1/2	1 3/4	14
7/16	1/2			1 1/8		1 1/2			14
1/2	9/16			1 1/4	1 1/2	1 3/4	2		12
5/8	23/32		1 1/4	1 1/2	1 3/4				12
3/4	13/16					2 1/8			10

Table III—Washer Bearing Pressures Corresponding to Safe Bolt Loads

Hole Size In.	Washer Bearing Pressure, Pounds per Square Inch A	B	C	D	E	F	G	H	Safe Bolt Load, Lb.
	Round Hole Washers								
1/4	750	330	188	115	72	42	25	11	270
5/16	1,250	550	315	192	127	74	41	19	450
3/8	1,890	830	475	289	192	112	62	28	680
7/16	2,580	1,135	650	396	263	153	85	39	930
1/2	3,500	1,536	867	536	356	207	121	52	1,260
9/16	5,620	3,460	1,410	860	570	332	185	84	2,020
	Square Hole Washers								
1/4			297	165	105	59	43	15	270
5/16			495	376	178	99	71	24	450
3/8			748	417	268	149	107	37	680
7/16			1,020	570	368	204	147	50	930
1/2			1,388	766	500	276	199	67	1,260
9/16			2,220	1,240	800	443	242	108	2,020

NOTE: Safe steel bolt strength is based on a factor of safety of 5 on 50,000 lb. per sq.in. ultimate strength, the area being taken at root of thread.

washers frequent use is made of waste or slug punchings where the prime consideration is the origin of the slug rather than its value as a washer, and in numerous cases is used "as is" even though its proportions are illogical from a design standpoint. The ideal situation is approached in the following example: Pressed steel seats are manufactured for agricultural machines that have a number of holes punched in them for purposes of ventilation and comfort of the occupant of the seat. This factor and the need for washers are satisfied at once by punching the holes in size and number to supply dominating washer demands. As the needs change, the washer sizes, and hence the punchings can be changed. Several hundred tons of washers are produced in this manner each year by one concern alone. The seat punchings are made in the flat stock before the forming operations.

Punches and dies are an important element in cost, particularly when a needlessly large number of sizes are specified. It will astonish more than one manager

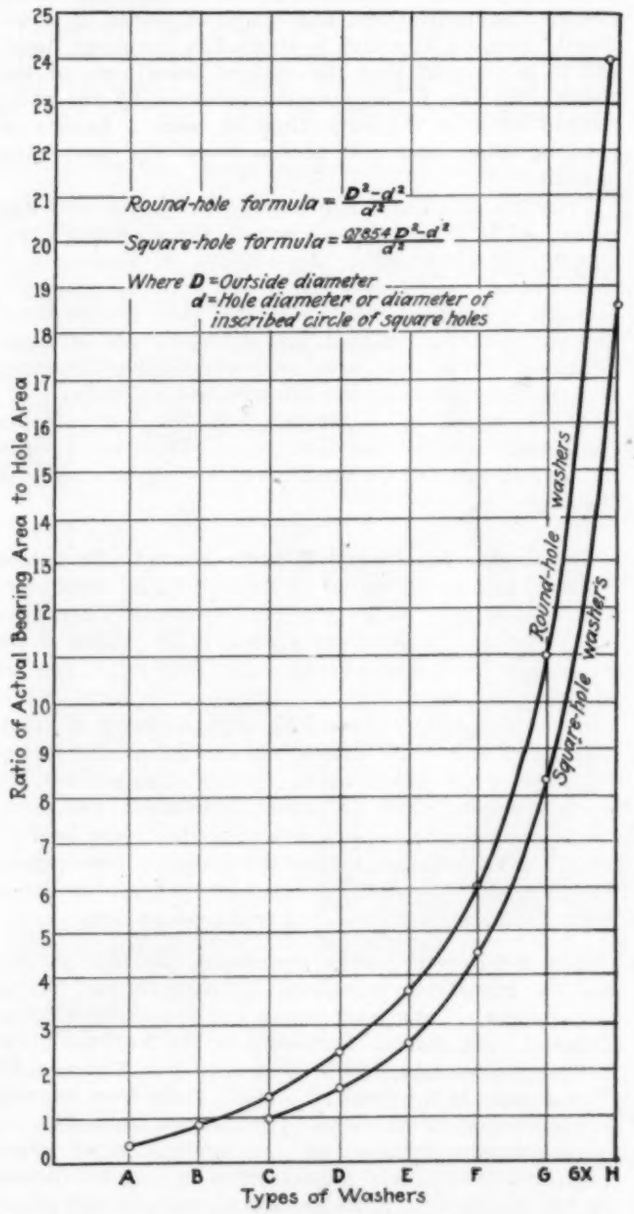

Round-hole formula = $\frac{D^2-d^2}{d^2}$
Square-hole formula = $\frac{.7854\,D^2-d^2}{d^2}$
Where D = Outside diameter
d = Hole diameter or diameter of inscribed circle of square holes
Ratio of Actual Bearing Area to Hole Area
Round-hole washers
Square-hole washers
A B C D E F G 6X H
Types of Washers

Fig. 6—Ratio of actual bearing area to hole area for each series of washers

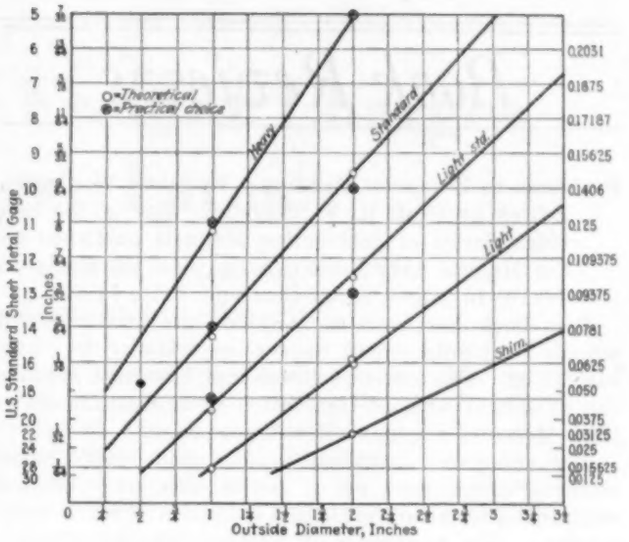


Fig. 7—Proposed standards for washer thickness

if he gives this point attention. The same condition influences the storage, recording, and distribution of washers; the greater the variety of size, the greater is this part of the cost.

Several careful estimates indicate that the actual handling of individual washers during assembly is the chief expense in the entire program. There is evidence for believing that this item of cost for ½-in. washers in ordinary assembly may be thirty times that of the other three groups mentioned. Any needless close fitting that delays assembly must materially enlarge this expense. It would be an interesting subject upon which to collect cost figures. In cases where mixing of approximately the same sizes might occur and re-sorting become necessary, it is obvious that it would not be sensible to save material at the expense of facilitating the separation of two washers of the same outside diameter but of different inside diameter, for example. The cost of re-sorting might be out of proportion to the value of the parts and a difference in outside diameter would be warranted.

Committees of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Agricultural Engineers are at work on this problem in the interest of an American standard series of washers. Suggestions offered freely along this line through the *American Machinist* will be highly appreciated. Each and every phase of the questions of design, nomenclature, material, tolerances, punches and dies, and numbering or lettering schemes are to be considered.

The need of a very complete review of even this simple machine element is fully recognized and the above proposals, while still in the transition stage, are submitted for the purpose of arousing constructive criticism. Free discussion of these points will result in the best possible analysis.

Buyers as a whole must pay for the sales costs of an industry. Individuals may lose money and pass out, but an industry as a whole must earn a living profit. Whatever the sales cost, it must be borne by the users. And they can do much toward reducing this cost by considering how they can avoid adding to an expense that is already too heavy.

Book Reviews

Problems in Blueprint Reading. By Drew W. Castle. Edited by Prof. R. W. Selvidge. One of the Selvidge Series of Instruction Manuals published by the Manual Arts Press, Peoria, Ill. Eighty-seven 7½x10½-in. pages, paper binding. Price $1.44.

This book has been written for use in industrial schools or plants where apprentice training is being carried on. The author believes that blueprint reading can be taught without instruction in mechanical drawing. Hence he employs a direct procedure.

The three-view principle is discussed briefly, then sections, dimensions, notes, conventions, and common mechanical terms are explained by means of many illustrations. The remainder of the book consists of alternate pages of thirty blueprint-reading problems. Each problem is presented in the form of a three-view layout of a small part. Six questions are asked about the drawing to test the student's understanding of it. The last question requires for an answer a sketch of a modified part on the cross-sectioned facing page provided for this purpose.

Air Service Engine Handbook. Compiled by Iskander Hourwich, formerly assistant engineer, and W. J. Foster, test engineer, Power Plant Laboratory, Engineering Division, McCook Field, Dayton, Ohio. Seven hundred 6x9-in. pages, 275 tables, 298 diagrams and illustrations, cloth boards. Indexed. Published by direction of the Chief of Air Service and under the supervision of Maj. John F. Curry, McCook Field, Dayton, Ohio.

This work is a handbook on the subject comparable to similar literature in other fields of engineering. The compilers have attempted to sift as much available material as possible on engine design, performance, and research, and to select for inclusion in the handbook only the most trustworthy information. Such sources as the U. S. Army Air Service, the Bureau of Standards, Bureau of Mines, the National (American) and British Advisory Committee for Aeronautics, the Society of Automotive Engineers, and the British Institute of Automobile Engineers have been used in general.

The book is divided into nine chapters. The first is made up of conversion tables and physical constants. The second is devoted to engine characteristics, dimensions, weights, fits, etc., while the third discusses materials. Performance data and testing, fuels, lubricants, carburetion, ignition, and cooling systems are covered in turn.

English and American Tool Builders. By Joseph W. Roe, Museum of the Peaceful Arts, City of New York, Professor of Industrial Engineering, New York University. Three hundred and fifteen pages, 6x9 inches. Illustrated and bound in cloth boards. Published by McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York. Price $4.

Professor Roe's book on the history of tool building in England and in America was first published in 1916 by the Yale University Press. It is well and favorably known throughout the metal-working industries. It had been out of print for several years when the present publishers arranged with the author for this reprinting.

A few mistakes in the original manuscript have been corrected but no attempt has been made to bring the later chapters up to the present time. As a matter of fact, so much has happened to tool builders since 1916, and so many developments have taken place that another volume could be written on that period alone.

The book is pleasant reading and well worth the study of any one who takes pride in the history and achievements of the master tool builders on whose efforts so much of our modern civilization depends.

Geometry of Engineering Drawing. Descriptive Geomerty by the Direct Method. By George J. Hood, M.E., Professor of Engineering Drawing, University of Kansas. Two hundred ninety pages, 6x9-in., cloth boards, illustrated. Indexed. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York. Price $2.50.

The usual method of teaching descriptive geometry, involving the use of planes of projection, quadrants, the ground line, projections, and traces of planes, is abandoned. Instead, attention is directed to the object itself, and it is thought that the student loses none of the mental training in imagination obtained by the older method while at the same time he gains a facility in drawing that does not accrue from the projection method.

Principle, auxiliary, and oblique views are first discussed so as to get the student to visualize and draw simple concrete objects. An analysis of structures is then presented, followed by a study of its elements, straight and curved lines, planes and their intersections, and single-curved, warped, and double-curved surfaces. Chapters on mining problems, perspective drawings and the projection method are included.

The problems are separated from the text and are contained in the last hundred pages. There are 1160 in all, divided into 105 groups for ready co-ordination with the text.

Developing Machinery Markets Abroad. Seventeen 5½x9-in. pages. Prepared by the Industrial Machinery Division, Bureau of Foreign and Domestic Commerce, Washington. This booklet gives a brief outline of the procedure for selling American machinery in foreign markets, together with a table showing increases in exports of industrial machinery over a period of years. The items taken up include discussions of the proper selection of a representative, foreign sales policies, the home organization of an export department, and terms of payment. The booklet is well written, and is more frank and to the point than the ordinary Government bulletin. A copy can be obtained gratis from the Industrial Machinery Division by any American firm.

Experience with Group Insurance. By the Committee on Industrial Relations, National Metal Trades Association. Twenty-six pages, 6x9 in., paper binding. Indexed. Six charts. Published by the National Metal Trades Association, 122 S. Michigan Ave., Chicago, Ill. This booklet is the result of a study made from answers to questionnaires mailed to 1,100 member companies. It is a complete treatise on the application of group insurance to industrial organizations, giving tabulations of the opinions of firms on the advantages and disadvantages of applying group insurance to cover their employees.

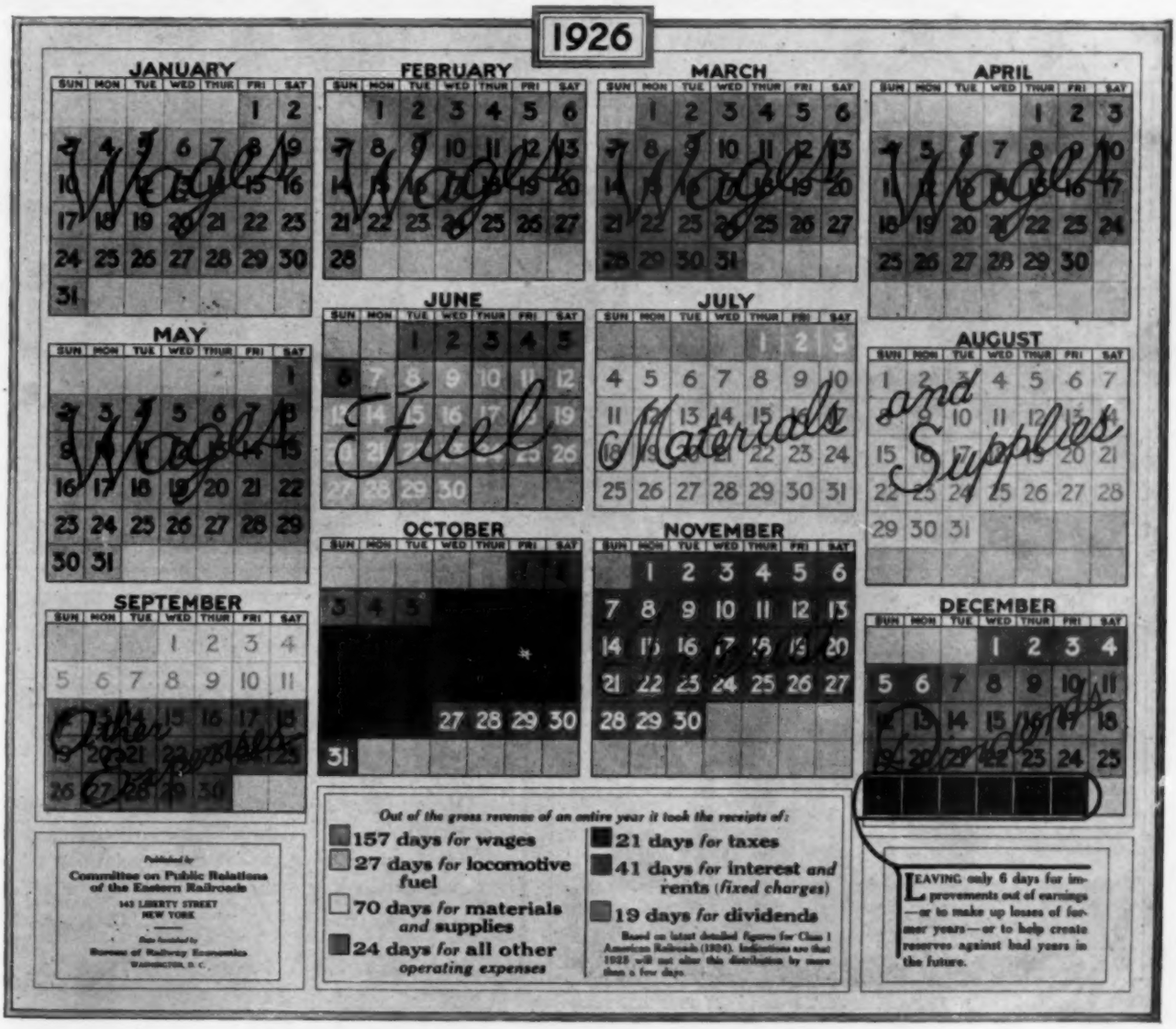
What Becomes of Freight Charges and Passenger Fares?

How much of the money taken in by the railroads is available for equipment purchases?

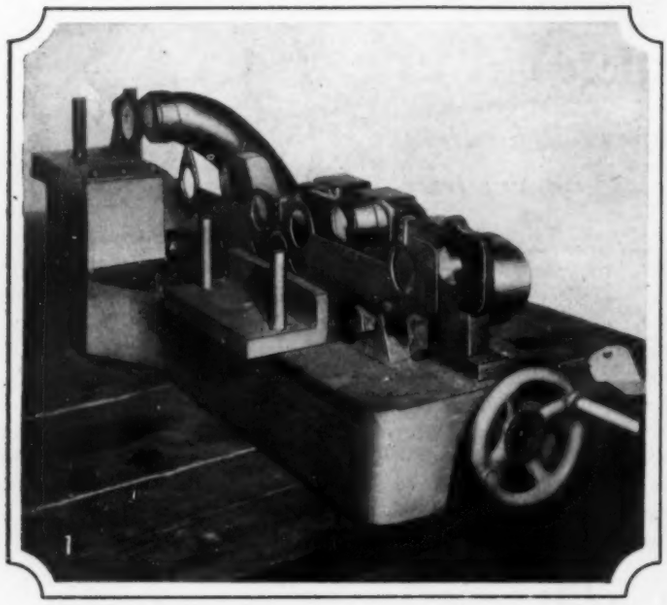
ACCORDING to the figures compiled by the Bureau of Railway Economics the division of gross revenues over a calendar year is something like this: Receipts on 157 days for wages, 27 days for locomotive fuel, 70 days for materials and supplies, 24 days for all other operating expenses, 21 days for taxes, 41 days for interest and rent, 19 days for dividends and 6 days for improvements out of earnings.

Please note the insignificant size of the last item. Measured in days it represents 6 out of 365 or something less than 2 per cent. Remember that new shops and new terminals must be built and equipped from this fraction of the railway income. And remember, too, that a considerable part of the cost of replacement equipment has to be charged to capital account and consequently comes out of the same fraction of income. It is small wonder, therefore, that many railroad shops are still limping along with an entirely inadequate proportion of modern equipment.

The Committee on Public Relations of the Eastern Railroads has taken the figures and applied them to the 1926 calendar, as shown in the illustration. The whole poster, of which the calendar forms the lower half, is to be displayed in railroad stations this summer.


1926
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
Wages
Wages
Wages
Wages
Fuel
Materials and Supplies
Other Expenses
Dividends
Out of the gross revenue of an entire year it took the receipts of:
157 days for wages
27 days for locomotive fuel
70 days for materials and supplies
24 days for all other operating expenses
21 days for taxes
41 days for interest and rents (fixed charges)
19 days for dividends
Based on latest detailed figures for Class I American Railroads (1924). Indications are that 1925 will not alter this distribution by more than a few days.
Published by
Committee on Public Relations of the Eastern Railroads
143 LIBERTY STREET
NEW YORK
Data furnished by
Bureau of Railway Economics
WASHINGTON, D. C.
LEAVING only 6 days for improvements out of earnings—or to make up losses of former years—or to help create reserves against bad years in the future.

Target Gages for Inspecting



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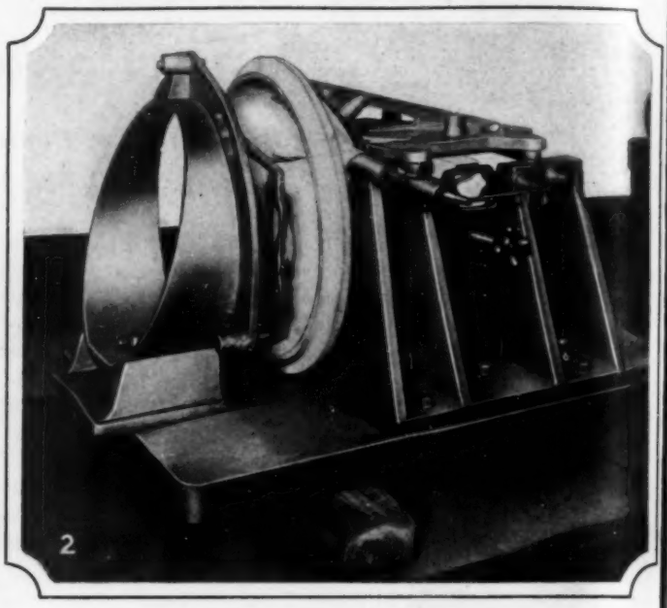

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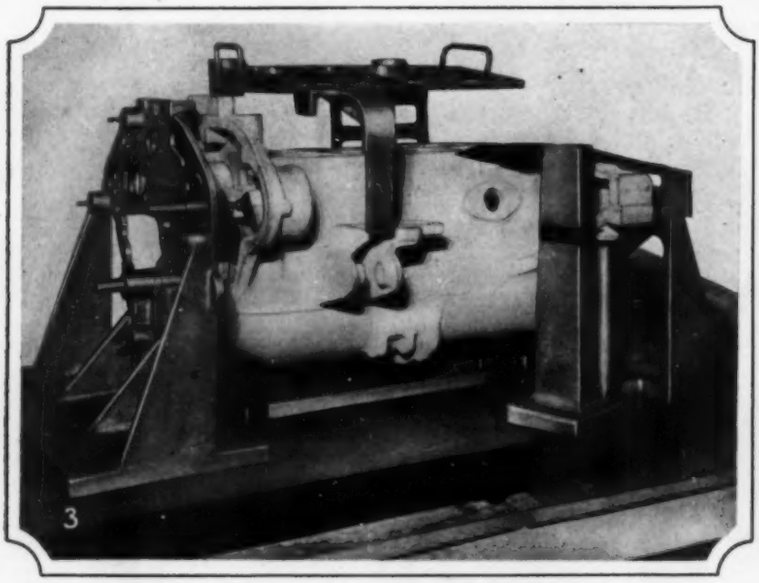

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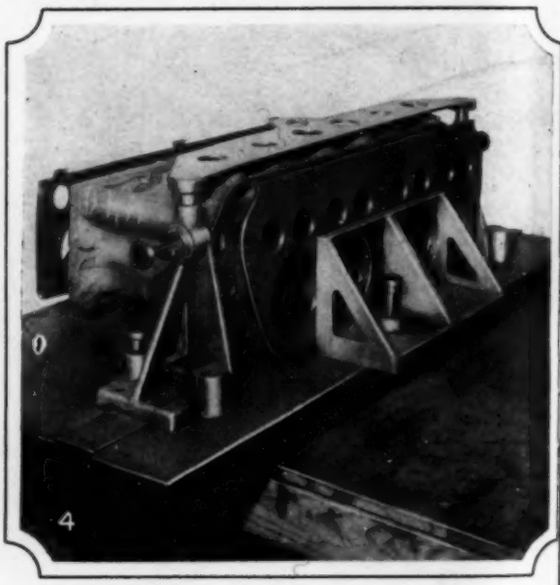

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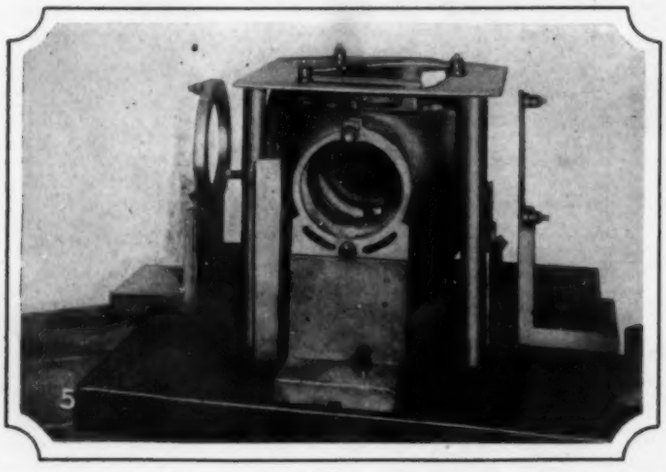

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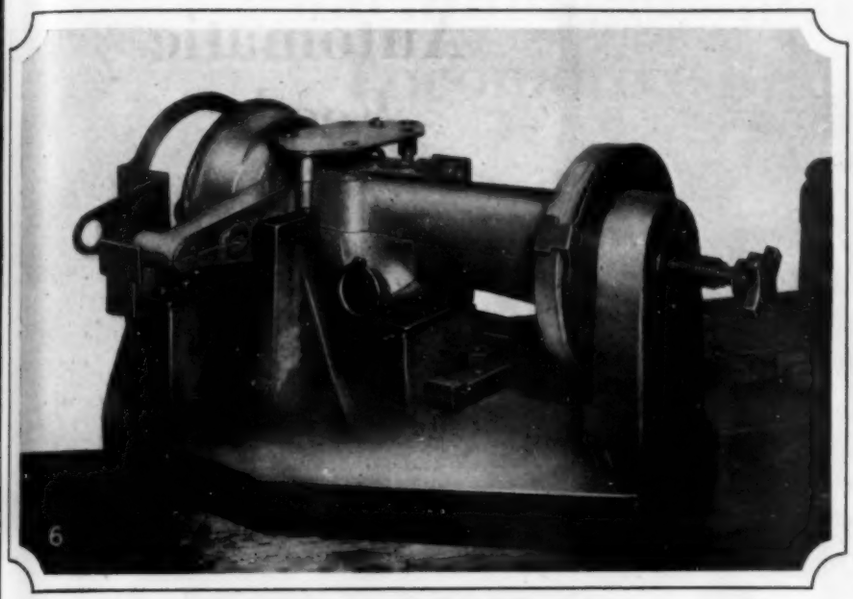
THE use of target gages is not new, as they were used for setting cylinders on boring machines in the early days of the automobile. But the White Motor Co., Cleveland, Ohio, was the first, to our knowledge, to use them so extensively, or so successfully, in being sure that every forging or casting that gets into the production line will "clean

Motor Castings and Forgings



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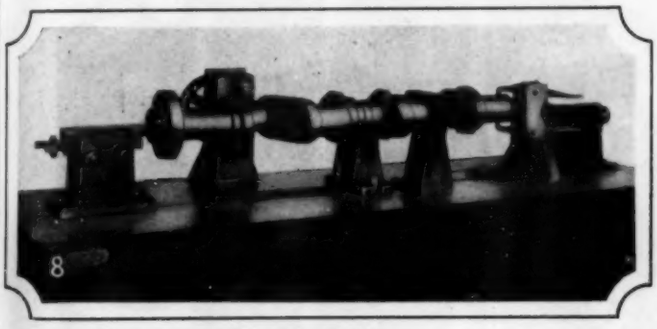

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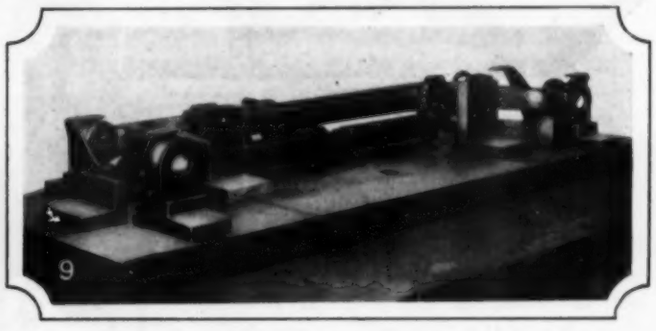

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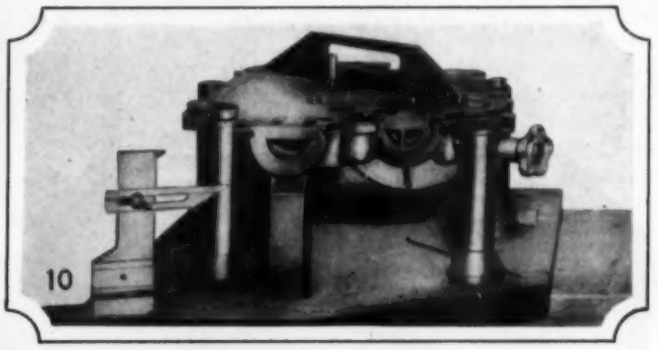
1—Target gages for manifolds
2—Inspecting a transmission case
3—Gages for testing crankcase casting
4—Inspecting the cylinder block
5—Differential carrier set-up for gaging
6—Part of a rear axle housing
7—Gages for inspecting brake drums
8—Crankshaft forging inspection
9—Inspecting a front axle forging
10—Cover of a transmission case
11—Testing the body of the case



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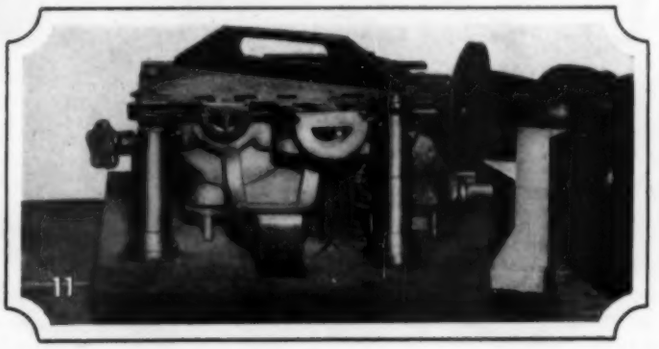
up." Both the foundry and the forge are provided with similar gages, so that very few pieces reach the shop that cannot be passed by the inspector of rough stores. The result is a remarkably low percentage of rejects on both castings and forgings, and a correspondingly low loss in production due to defective material.



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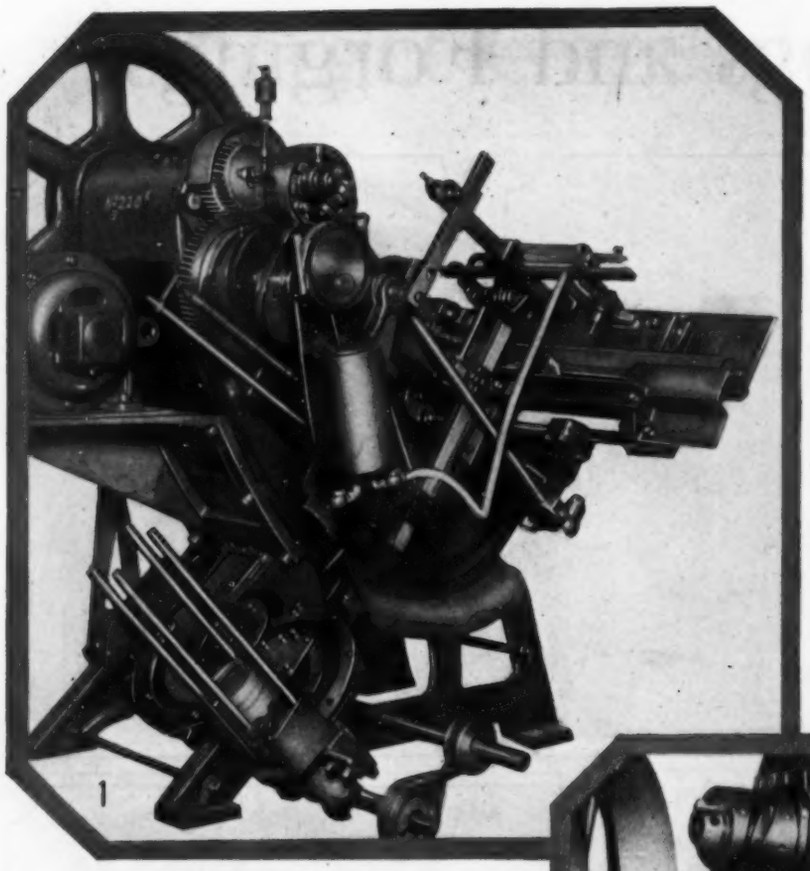
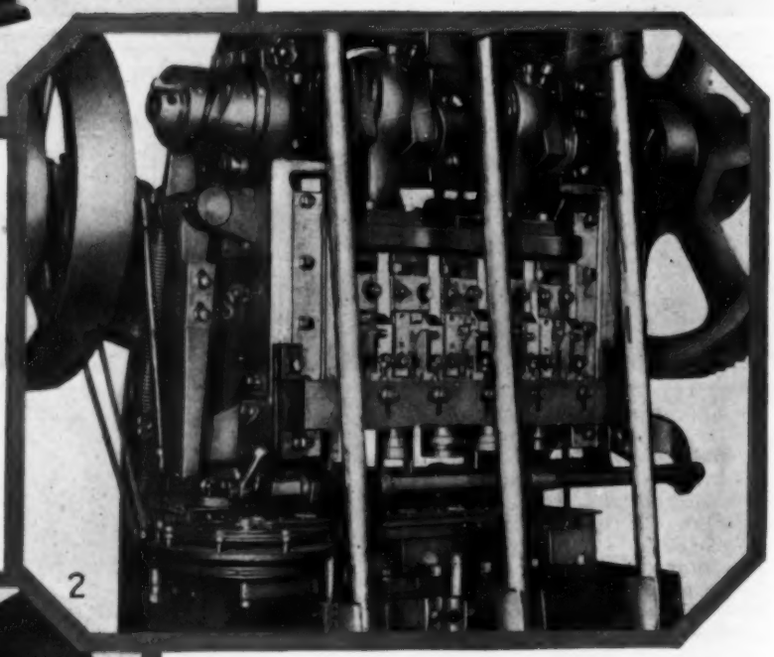
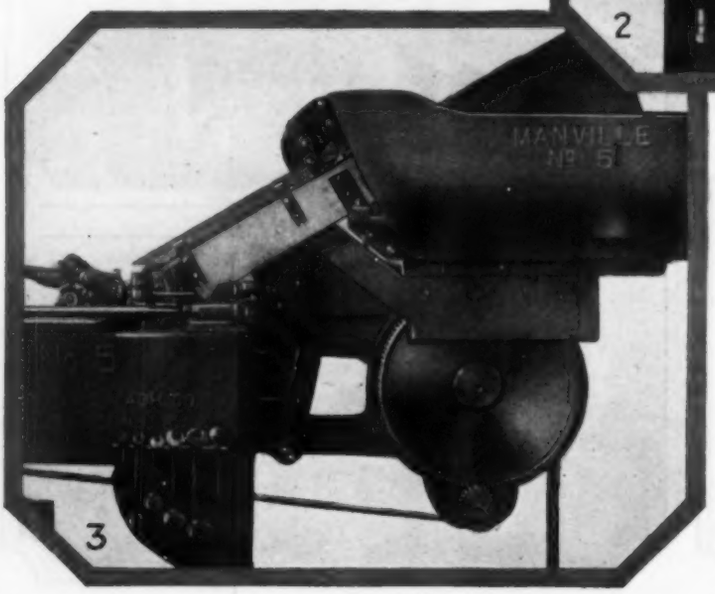
Automatic Feeds



1—Bliss press for making tops and bottoms of sanitary cans. The suction feed takes plates from the platen to the carrier feed, which grips and carries the strips through the dies



2—Bliss gang press with friction dial feed for feeding shells into press, and lateral feed, operated by the cam, for carrying the shell to each of the 5 operations, which are all performed at a single stroke



3—Manville thread roller with lifting feed plate that gathers bolt blanks and raises them so they can slide down the incline to the rolling dies

Machining Methods That Cut Locomotive-Repair Costs

By Frank W. Curtis
Western Editor, *American Machinist*

Superheater flues cut out by an air tool—Turning in a drill press—Trepanning flue sheets—Gages made in a punch press

IN THE Union Pacific Shops at Omaha, the ends of superheater flues are cut off with the air-operated device shown in Fig. 15, and detailed in Fig. 16. The motor is mounted on the shank *A* which carries a 20-tooth gear. In mesh with this gear is an idler gear that engages the driven gear *B*, mounted on the spindle. The roller cutter *C*, is mounted in a block near the outer end of the spindle, the block being arranged to move crosswise of the spindle by longitudinal motion of the inclined plunger *D*. The plunger is connected to the feed plate *E* by a feed screw. In operation, the spindle is inserted in the flue, after which the air motor is started. By holding the handle *H* attached to the feed plate, while the spindle is revolving, the plunger is carried forward causing the cutter to move outward from the spindle. A flue is cut off in a few revolutions, then the cutter is withdrawn by stopping the device and revolving the feed plate. The operation is then repeated on the next flue.

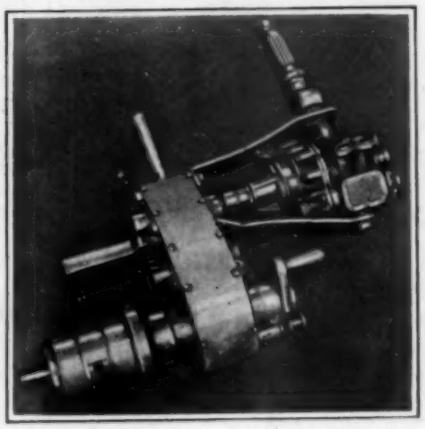


Fig. 15—Air-operated, superheater flue cutter

Piston rings are cut from a pot casting machined in the 36-in. Niles-Bement-Pond boring mill illustrated in Fig. 17. The casting shown has been turned to 26¼ in. in diameter and bored to 25⅛ in. diameter, and was originally long enough to make 24 rings. Sixteen rings have been made from it, and the tools are now set for finishing the balance. The side head is equipped with a toolholder in which eight ⅛-in. parting tools are held.

Instead of turning link-saddle pins in a lathe, requiring an awkward set-up, the operation is handled in a Baker drill press as shown in Fig. 18. The work is clamped at each end on parallels, the pin being in a vertical position. A single-point tool mounted in an adjustable toolholder is set to the required diameter and is fed downward. The speed is 50 r.p.m. and the feed is 0.025 in. per revolution. The holder is arranged to slide crosswise and is provided with a star feed so that the top face and bottom shoulder of the pin can be faced in the same setting. Cuts up to ⅛ in. in depth are taken, although an amount sufficient to clean up the worn surface is the main requirement. In the event that the pins are worn below a permissible limit, sleeves are put on and then turned to size. The pin is polished in the same set-up by abrasive cloth mounted on a wooden block attached to the machine spindle.

Holes in the flue sheets are cut in a Foote-Burt 3-spindle drill, Fig. 19, equipped with trepanning tools, each having three cutters and a pilot. The cut is taken at 30 r.p.m. and the feed is 0.005 in. per revolution, necessitating approximately 4 min. to cut out the piece shown standing at the right. Soda-water cutting compound, supplied from cans having a ⅜-in. outlet, is used.

Compressed air is used for many purposes, and, in some cases, to operate home-made machines. Fig. 20 shows a machine made of odd pieces, used for several operations. A piston rod is shown set up for milling the key slot in the crosshead end. The work is clamped in V-blocks. The table is provided with ways and is operated by a screw attached

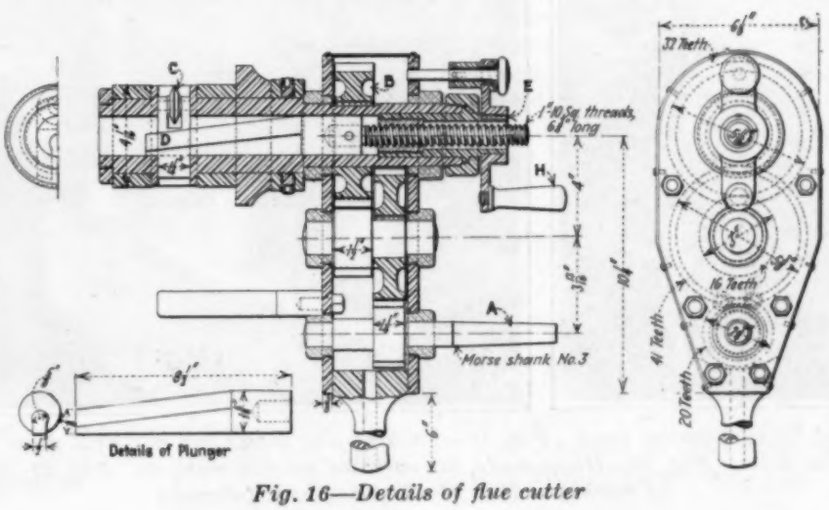


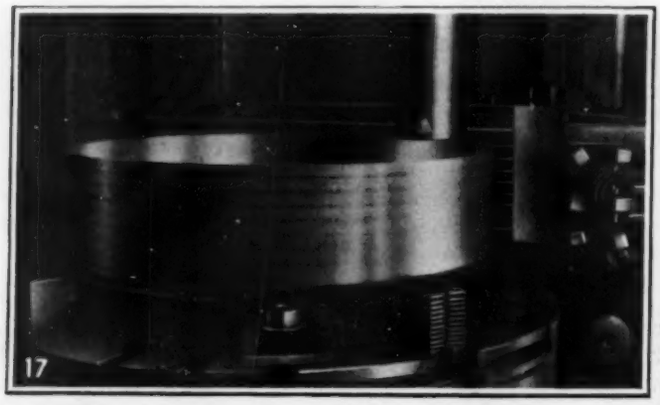
Fig. 16—Details of flue cutter

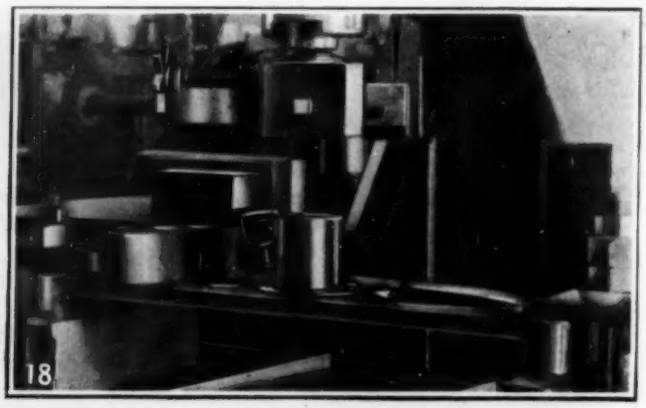
The concluding article

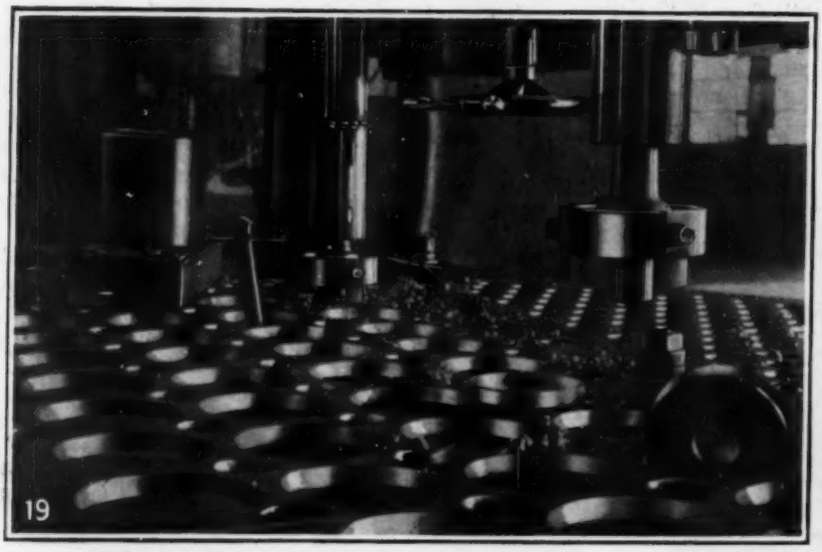
to the handwheel shown at the front end. A hole is drilled in the rod and the helical cutter passes through it, the piloted end running in a bearing in the bed of the machine. An air motor attached to two upright supports is connected to the shank of the cutter. The feed is by worm gearing driven by belt from a pulley on the motor spindle.

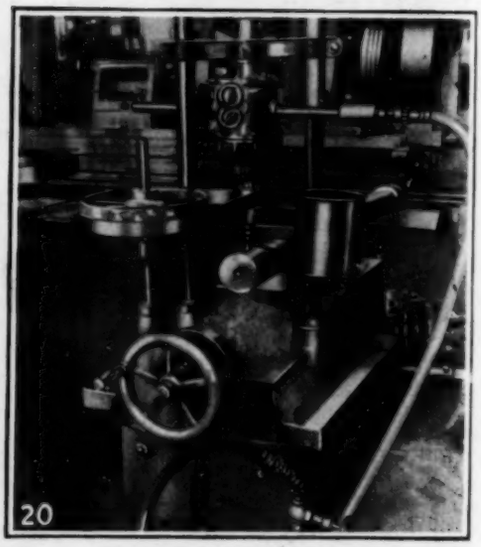
A close-up view of the machine, Fig. 21, shows a throttle-lever jaw set up for milling between the jaws, The shank end of the work is held by two setscrews in a bar clamped in the V-blocks. A $\frac{7}{8}$-in. cutter machines the opening in the work to a depth of 3 in. A finished piece is shown standing on the front end of the ways. Cutting oil is fed to the cutter from an oil can located on one of the upright supports.

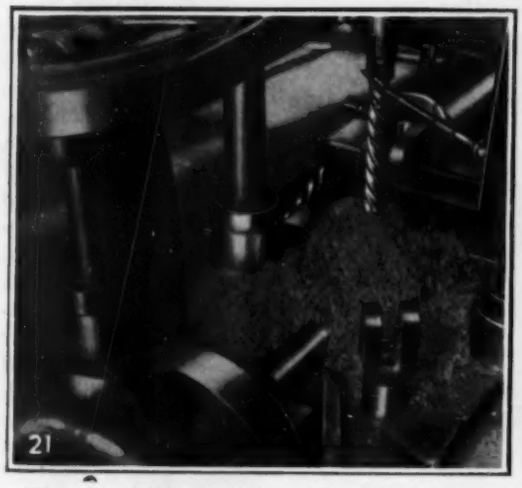
Split followers used with metallic piston-packing are turned in a Niles-Bement-Pond lathe in which a chuck arranged to hold three sizes, is used. Fig. 22 illustrates the work set up for turning, while on the compound rest is shown a completed unit. Details of the chuck are shown in Fig. 23. The flange of the work in position is $6\frac{7}{8}$ in. in diameter, although the chuck











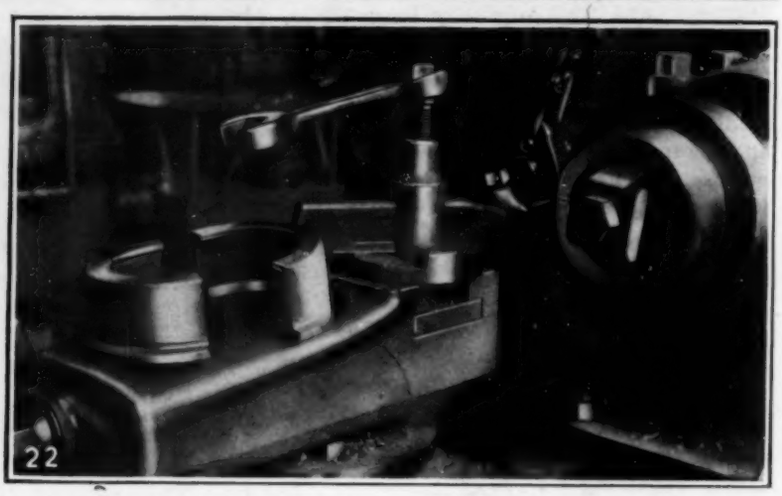


Fig. 17—Method of turning piston rings. Fig. 18—Turning link-saddle pin in a drill press. Fig. 19—Cutting superheater flue holes. Fig. 20—Home-made, air-operated milling machine. Fig. 21—Close-up view of machine. Fig. 22—Turning split followers

is arranged with steps as at *A* and *B* to handle pieces with flanges of other sizes. A clamping plate arranged with two adjustable clamps is operated by a capscrew that fits in the chuck body. The work is placed in the chuck so that each half is held by one of the clamps. By the use of this chuck the operation has been simplified because both halves of the work can be located quickly.

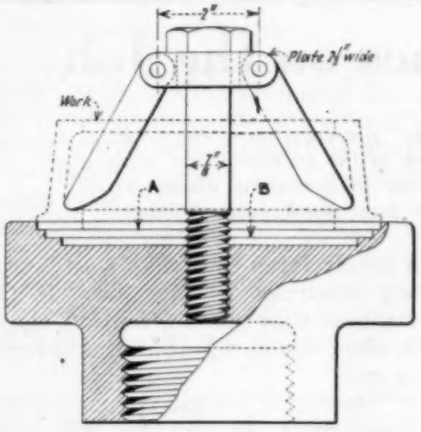


Fig. 23—Adapter used in turning followers

Wheel-defect gages, used over the entire system, are made in quantity lots to insure uniformity and are distributed from stock as desired. The gages, of ⅛-in. sheet steel, are made in the die shown in Fig. 24. A strip ⅝ in. wide and 30 in. long is fed through the punch and die, shown respectively at *A* and *B*, producing the gage *C*. The die is of the progressive type, first punching the hole and the notches in one end, after which the work is fed one length to complete the contour and the opposite end. Instead of lettering the gages by hand, the operation is handled in a press using the lettering block *D* and work holder *E*. The lettering block was made by pressing it in the unhardened condition, under hydraulic pressure, against the hardened plate *H* on which the lettering was stamped by hand. The impressions on the plate are made as deep as possible so they will transfer correspondingly. The block is then hardened and mounted on the punch holder. Gages used for checking the work before and after hardening are shown at *K*.

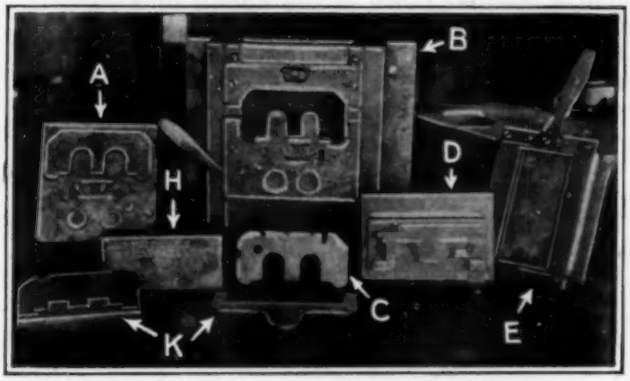


Fig. 24—Tools for making wheel gages

When trying out new metals it is advisable to tell the makers exactly to what sort of uses they are to be put. This not only saves money but may prevent failure. In using aluminum or its alloys for example, ordinary castings may answer in some places, while for other duties, a special alloy that can be heat treated is necessary. It is unfair to condemn any material that has not been used in accordance with the best experience of its manufacturers.

Seen and Heard

By John R. Godfrey

Ironing the humps out of unemployment

IT SEEMS to be pretty well agreed that the great bugbear that stares the average worker in the face is the dread of losing his job. Not that he always has any great love for the job itself, but he must have employment in order to earn a living for himself and his family. In a sense the business man is up against the same thing, except that he has a wider margin between the losing of his job and the end of his bank roll. In both cases it is the fear that he may not be able to earn a living, because of a lack of opportunity to swap his skill for enough coin of the realm to induce the butcher and baker to part with frankfurters and rolls for the family sustenance. Incidentally, too, there is the matter of rent, clothes and other such luxuries.

If the average worker could be assured of steady work he'd do a lot less worrying and probably do a lot more work at times. For it takes a man with an angelic turn of mind to see how soon he can work himself out of a job. And there aren't many real angels floating around this neck of the woods.

One company that employs about 500 men is trying out a plan to stabilize employment by the use of a flexible work-day or -week. And it sounds as though it had possibilities that were worth looking into.

The plan is to have a flexible work-week with 44 hr. as the base. Average business over a period of years indicates that it can keep 500 people busy for 44 hr. a week. If business is brisk it lets the employees decide whether to work longer hours or bring in more people temporarily. Up to now they have chosen to work longer hours, the maximum week being 52 hr. All time over 44 hr. is paid for at "time and a half" rate—which is probably one reason they prefer to stretch out the hours rather than have more people hired. The way the hours are added is also left to the men. They can add some to each day or add them to the first five days only, leaving Saturday afternoon free if they prefer.

This same company has an unemployment fund that is very unusual. It is based on the accumulation of a sum of money to which the company makes additions whenever the amount falls below twice the maximum weekly payroll for the preceding twelve months. The fund is handled by a trust company that invests the funds and pays such employees as may be temporarily laid off on account of slack business, when so authorized by a special committee. This fund is for regular employees who earn less than $50 a week. Those having dependents get 75 per cent and those without dependents, 50 per cent of their normal wage.

Other concerns are trying out various plans of paying their unemployed, and it is a healthy sign that the question is being considered at all. It's a sign that "the world do move" and that we are getting more human as the years go by.

Don't demand a closer tolerance than is necessary on any job. Extreme accuracy costs money and is a waste of effort when not needed.

THE · FOREMAN'S · ROUND · TABLE

Keeping Machines on the Job

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"SAY, Al, what's this bunk I've been hearing about repairing machines before they break down? How in blazes do you know what is going to break until it lets go? Sounds fishy to me, Al." Ed, the foreman, was talking to Al on the way home from work.

"Well, Ed, there are several ways of looking at it. Perhaps you can't tell just what will break, but you can certainly keep tabs on wear of bearings and such. But it isn't bunk, by a long ways, to watch for wear and loose bolts, nuts and shafts in order to prevent having a machine go out of business."

"But how can you tell about worn bearings without tearing a machine down? We can't stop to do that, you know, Al."

"Did you ever think of machines in the shop in the same way you do of your flivver, Ed? Do you just run the old bus till something busts or do you go over it once in a while to see if spring clamp bolts have loosened up, if steering spindles are worn, or the rims are loose on the wheels? You don't have to pull it apart to know when the steering gear needs taking up. When it begins to wabble, you look for trouble without waiting for it to break down, don't you?"

"But, Al, how can we tell what's going on inside the gear box or feed gear train of an automatic? 'Tain't like an automobile, is it?"

"Machinery is machinery, Ed. If you can prevent breakdowns on flivvers you can on most machines in the shop if you give 'em a little attention. You generally go over your old bus once every week or so on general principles. But when the whistle blows the average shop man forgets there are gears and bearings in the machine that gives him a chance to earn his pay. Some shops keep a repair force that take sole charge of keeping machines on the job. If they find a machine that needs attention, they can order it shut down, whether the foreman likes it or not."

"Darned if I want anyone butting into my department, Al. Rather look after the machines myself — and we don't have many breakdowns, Al."

"Ed, old boy, it isn't what you and I want that pays dividends. It's the big boss's job to keep machines at work and if he can do it best by taking the machines out of our hands when they need repairs, that's the thing to do. Just forget any false pride—it's production we need, for that means dividends and the possibility of better pay.

"If the repair man has horse sense he'll try to work with the foreman, and he won't pull a machine down in the middle of a run unless he thinks it absolutely necessary. If they can't work together to secure the least delays, they better learn something about team work. You wouldn't have any trouble with a repair man, Ed, if he came to you in a friendly way and showed you where it would save a lot more dollars to shut down than to run."

"That's all right, Al, but I want to be boss of my department. Why couldn't the repair man work for me instead of on his own?"

"That's easy, Ed. Working on his own he's responsible to the boss for keeping machines on the job. And they've found in some of the big shops that it pays better to keep him on his own. They don't have so many breakdowns and repairs don't cost as much. We can't buck results, Ed, even if our pride does get a wallop once in a while."

Can breakdowns be prevented or reduced as Al suggests?
Do we take better care of our cars than we do our machines in the shop?
Will the repair man get better results if he is independent of the foremen?
Or is it better to have him under the foreman as Ed would like to have him?

All foremen are urged to discuss these questions from their own experience. Acceptable letters will be paid for. The discussion is not limited to foremen, of course.

THE · FOREMAN'S · ROUND · TABLE

No Monopoly of Brains

NO ONE man can have all the brains or all the ideas. The more thoroughly a man appreciates this fact the better leader he will be. The men who actually perform the work are in a better position to create shortcuts and improvements than any one else in an organization if encouraged to do so.

The foreman is in closer touch with the work than the superintendent and does not have as many different things to think about and accomplish. It, therefore, stands to reason that suggestions and ideas from the men should come to the foreman who will carefully consider them and, if in his opinion they are worthy or should have further consideration, he will, if he is an intelligent foreman, accept and put into use minor improvements and changes and pass the others on to the superintendent for his opinion and action, thereby relieving the superintendent of details and giving him the benefit of ideas recommended by his foreman.

Any man, whether he be mechanic, foreman, superintendent or manager, is a fool if he steals another man's idea or suggestion and passes it as his own because if no one else even knows about it he has admitted to himself that he is a failure and resorted to theft in order to fool some one else—and the latter cannot always be done.

Every suggestion or idea should be courteously acknowledged and if of great value the employee or employees responsible for it in its completed form should be properly rewarded, including the foreman and superintendent who were instrumental in its consideration, adoption and installation.—F. HOMER THOMAS.

THE · NEXT · TOPIC

How do you pick assistants?

Is it good policy to have understudies for important jobs?

Is it wiser to bring in foremen from outside or to promote from the ranks?

Are records of any use in picking men for promotion?

Is it a good plan for the foreman to go out occasionally and leave the straw-boss in charge?

Suggestion Should Clear Through the Foreman

I BELIEVE Al was right in sending Scotty to Williams, as Scotty could put his ideas across first-hand. By encouraging a fellow workman to benefit the company he was working for, Al opened the path for co-operation with the other employees under his supervision.

All suggestions that must be brought to the attention of another department should pass through the hands of the foreman of the department where the suggestion originated, and with just credit given the suggester, unless there is a systematic suggestion policy in use, in which case the original suggester would receive full credit.

Scotty's services did not require him to fill the position of a designer or engineer, if one can judge from the information so many foremen have received from the engineering department of their respective plants that the foremen and the men under them are not supposed to possess any mental capacity, let alone use it.

But the foremen are thankful that there are exceptions to all rules, especially this one.—BURTON TAYLOR.

The Super Has a Broader Outlook

I FEEL that Al was right in sending Scotty to Williams since the Super, having the entire plant under his supervision, has a larger vision as to the value of a suggestion. Before seeing the Super, however, the man should present his idea to the foreman in charge who would hand him an O.K.'d printed form, showing that he was cognizant of the plan.

The old superintendent was right in refusing to deal directly with the men, as the foreman should know what is going on and would feel slighted and disgruntled under any other system.

Al is certainly not in any danger of losing his job to Scotty if Williams is actually the broadminded executive that Al says he is. If Scotty's idea is feasible, he should be rewarded by receiving a cash payment or bonus of a certain percentage of the net savings on the job, as he has done more than his particular job calls for. Williams is likely to favor the suggestion of foremen's meetings, as any progressive Super should, because there is bound to be a valuable interchange of ideas and a drifting out of ruts and methods that have often been unconsciously acquired through long years of service in one plant. Again, the new man in the plant may gain a better idea of the policies of the firm by meeting the other foremen in a round table discussion, and a better feeling of good comradeship is likely to result—if the meetings are carried on in a businesslike manner.—WALTER E. SCHOBER.

What Any Real Mechanic Would Do

AL IS in no danger of losing his job as the result of one suggestion whatever its merit. Scotty has done what every real mechanic would do, i.e., his very best service to the job and in so doing, the best service to himself. He should be encouraged, first by open acknowledgment of credit for the scheme, then by having some active part in putting his suggestion into practice. If it is a matter of large saving, as in the case cited, Scotty should certainly get something more substantial than satisfaction, although pride in acknowledged achievement is in itself a wonderful stimulus to further effort. —JAMES H. UPTON.

Ideas from Practical Men

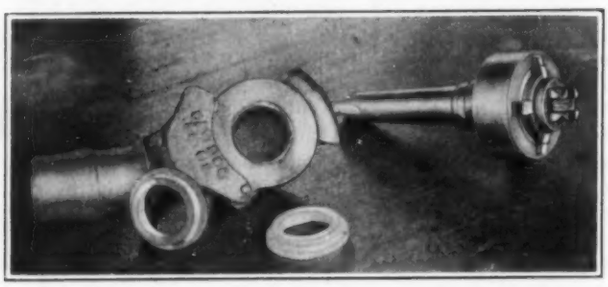
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Tool for Cleaning Air-Hose Couplings

BY GEORGE FELTNER

In salvaging air-hose couplings it is usually difficult to remove the particles of deteriorated gaskets, rust and dirt that accumulate in the gasket recesses, unless a cutting tool is used. If the recesses are not cleaned properly, new gaskets will not fit as they should, causing leaky connections when the couplings are in use.

The illustration shows a tool devised for overcoming this difficulty. It is used in a drill press in connection with a vise that holds the coupling. The tool is lowered to the work so the body strikes the flange face of the coupling. Four cutters, mounted in the body, pass into the opening of the work in this position. As the machine spindle continues downward, the cutters are expanded by a tapered plunger. The cutters, fitted into slots of the tool body, are L-shaped and ground to a round-nose edge so they fit the recess. The tool is not intended to cut the metal portion of the coupling, but



Air-hose coupling tool

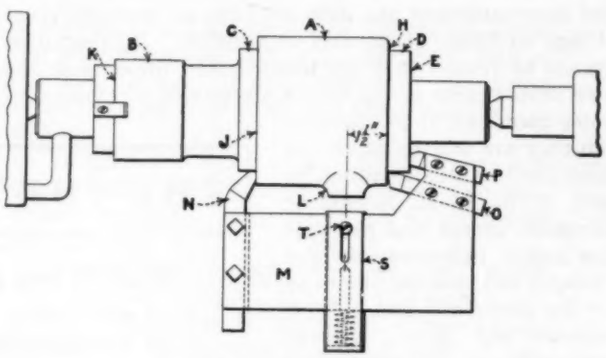
only to scrape out whatever foreign material there is in the recess. To preclude the danger of forcing the cutters beyond the recess a setscrew is provided on the plunger that limits its expanding movement. A spring is used to draw in the tools as the plunger recedes. To the left of the tool is shown a coupling and the gaskets used with it.

Multiple Tool for Facing and Gaging

BY C. W. PARKS

The cast iron housing *A*, shown in illustrations, was to be turned at *B*, *C* and *D*, and faced at *E*, *H* and *J*. The work was done on an engine lathe with special tooling.

Previous to this operation, the hole had been bored and the end *K* faced on another machine. The tools used for turning *B*, *C* and *D* are of the ordinary type and require no description, but the tool used for facing are rather odd in their design. In the first place, the



Multiple toolblock

requirements of the work called for close measurements between faces *H* and *J*, and *E* and *H*. Also the shoulder *H* was to be located 1½ in. from the center of the rough boss *L*. To preserve these dimensions, a special toolblock *M* was made of cast iron and equipped with adjustable tools at *N*, *O* and *P*, for facing down the shoulders previously specified. In order to preserve the relation between the center of the boss and the tools, th sliding gage *S* was used. The gage is a piece of cold-rolled steel, sliding in a dovetail slot on top of the tool block. Before starting to face, the operator adjusts the lathe carriage longitudinally until the sliding gage lines up with the boss *L*, and then locks the carriage in position. When the feed is engaged, the tools *P* and *O* face the surfaces *E* and *H*, while tool *N* faces *J*. The tool settings are preserved by sliding the gage forward and locking it in position by the screw at *T*, while using size blocks between the gage and tool, for setting each one. This arrangement ties up the relation of all tools with each other and with the boss *L*.

Quick-Action Toolpost and Tools for the Engine Lathe

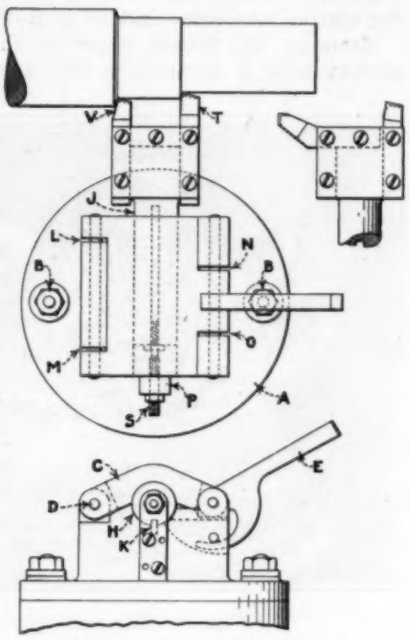
BY ANDREW ATKINS

Some manufacturing lathes are provided with turret toolposts for the carriage, permitting several tools to be so placed that they can be used in sequence on the work as required. When more than four tools are needed, other means must be employed, and the device shown in the illustration can be used to advantage.

The upper part of the compound rest is removed and in its place a special casting *A* is attached by the two bolts *B*. The casting is fitted with a steel leaf *C*, hinged at *D*, and has a cam lever *E* at the other side for locking it in position. The body of the casting and the

leaf are bored out together at *H* to receive the tool holder *J*. A spline is also cut in the casting at *K* and a permanent key put in. To guard against undue wear and inaccuracies, the hinge and casting are both fitted with hardened steel wear plates at *L*, *M*, *N* and *O*.

An adjustable end stop for the toolholder is a steel plate *P*, fastened to the base casting and provided with a setscrew and locknut at *S*. The toolholder is splined on the under side to fit the key in the base casting. The large end is slotted to receive substantial tools of standard section, as indicated at *T* and *V*.



Tool post used in place of compound rest

Special tools can be made for any complicated work and fitted to the holders, of which, obviously, there are a number provided. The construction is such that it is possible to do considerable heavy cutting without chatter, either on steel or cast iron, and work may be held close to size by making suitable adjustment to the setscrew placed in the end of each toolholder. This screw strikes against the screw *S* in the end stop, and gives a very accurate location for the tools. There is little likelihood of trouble being caused by dirt or chips, due to the protected situation of the screws.

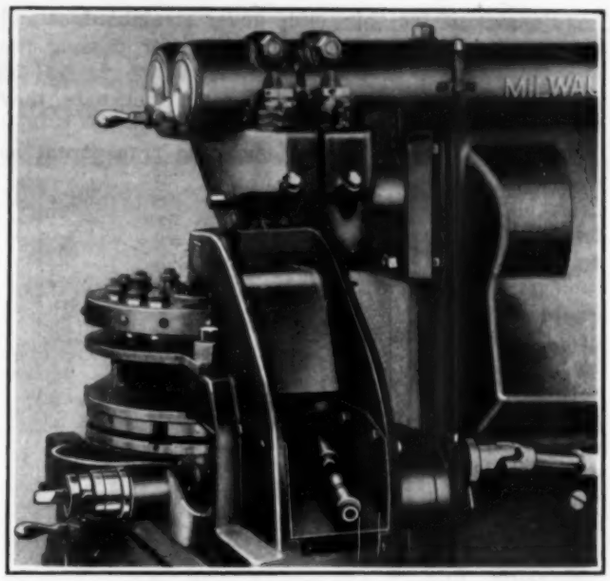
When using the device, the operator raises the lever *E* and throws back the latch, allowing the holder to be removed with ease and another one substituted. By pulling the holder back firmly against the stop screw, when tightening the cam lever, a positive location is assured. When turning a number of diameters not greatly different in size, the tools can be set so that no change is necessary in the cross-slide setting for the different diameters. With considerable differences in machined sizes, one or two settings of the cross-slide dial will usually be found sufficient.

This arrangement has been found to be a great time saver on engine-lathe work, particularly when the work is put through in small lots. In such cases, the toolholders can be set up for the job and can be put away in the toolcrib, without disturbing the settings, until the next time they are wanted.

Fixture That Automatically Clamps and Ejects the Work

By J. E. Webb

The fixture shown in the illustration is used for milling two narrow flats on some special bushings, and holds 18 pieces. The bushings are fed into holes in a



Automatic clamping and ejecting fixture

dial plate, being located for height by resting on a hardened and ground plate. As the fixture revolves, the bushings travel along the locating plate, but before they reach the end they are automatically clamped by wedges operated by a cam in the center of the fixture. Each station of the fixture holds two pieces, both of which are clamped by one wedge.

Upon completion of the milling, the bushings are released and ejected automatically. A hardened spring plunger in the outer ring of the fixture contacts with a wiping cam on the inside of the fixture arm, releasing the wedges and allowing the bushings to drop into a discharge chute.

The fixture is used on a Kearney & Trecker milling machine equipped with a rotary table and a special, two-spindle vertical head. The spindle of the outer head is adjustable both horizontally and vertically to provide for cutter wear and alignment. The production is 1,500 per hour.

Company Furnishes Standardized Triangles

By J. Madden

The accompanying illustration shows the specifications that are given to the manufacturers of the triangles used by the designers and draftsmen of the Morgan Construction Co., of Worcester, Mass. As the result of long experience the company found it advantageous to standardize the triangles used in the drafting room, the department of the highest paid workers of the organization. All draftsmen use the company triangles, which are charged to the individuals as are shop tools to machinists. Some of the reasons for the company expense are:

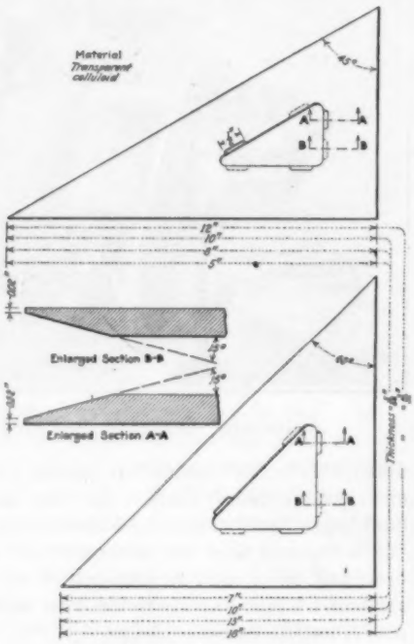
Draftsmen cannot be depended upon to provide themselves with good tools, particularly triangles.

It is important that the working edges of triangles have a certain minimum thickness in order that the upper portion be used as a fulcrum over which the pencil or pen may be inclined to vary the position of the lines, and thus avoid accurate placing of the triangle. This feature saves much time.

Triangles, if too thin, slide under straightedges and T-squares, and, on inclined boards, after passing the straightedge, will drop to the floor.

Unless triangles have considerable thickness they tend to warp and are difficult to pick up.

It is desirable to have triangles as transparent as possible. It is desirable to use triangles of uniform size in the same room because of frequent borrowing back and forth between draftsmen. The angles of a thick triangle will remain constant and will not require frequent redressing for accuracy.



Standards for drafting room triangles

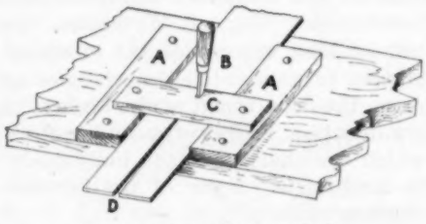
The furnishing of triangles by the company, of itself only the development of a common practice by many firms to supply unusual sizes, has resulted in better drawings made in less time. As shown in the illustration, there are four sizes each of the 45- and 60-deg. triangles. The material is translucent celluloid. The sections *A-A* and *B-B* show the angle of the finger holds.

An Easy Method of Slitting Belts

BY CHARLES KUGLER

Sometimes when a narrow belt is wanted in a hurry and there is no belting in stock of the width wanted, it will pay to cut down a piece of wider belting.

The slitting can be done by the very simple apparatus shown in the sketch. The components are, a few boards, some nails and a knife. The two boards *A* are nailed to the bench at the proper distance apart to act as guides for the belt *B*. The board *C*, having a notch to accomodate the knife, is nailed across them, as shown. After slitting the belt for a few inches from the end, it is placed in the device, and the knife is driven into the bench. By pulling the belt at *D*, it can readily be split.



Device for slitting belts

A joiner's clamp attached to the end of the belt affords a very convenient grip by which to do the pulling.

Milling Fixture for Automobile Spring Hangers

BY M. J. RICHARDSON

To meet increased production, it was necessary for us to make spring hangers at the rate of 400 per hour. Since there were four faces to be milled on each hanger, requiring the removal of ⅛ in. of stock from each face, the matter was somewhat of a problem.

However, the fixture shown in Fig. 1, used in connection with a Kempsmith No. 4 vertical Maximiller

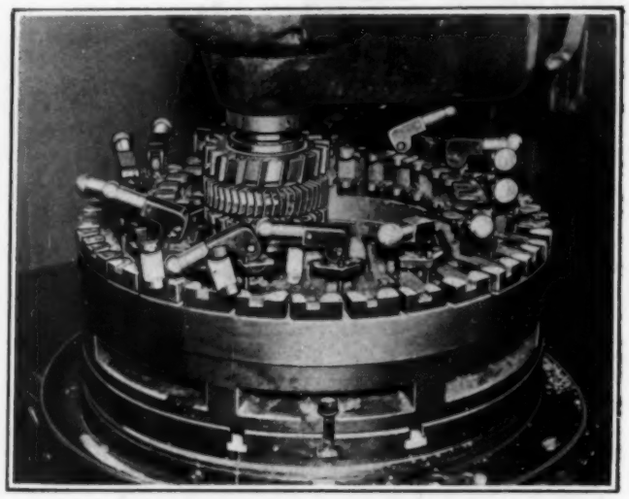


Fig. 1—The milling fixture

of the continuous type, enabled us to keep up to schedule.

The fixture holds 30 hangers, and is loaded and unloaded while the machine is in operation. Two hangers are clamped by each of fifteen quick-acting clamps, operated by cam levers.

The cutters, all of which are 10 in. in diameter, are mounted on a stub arbor and are run at a cutting speed of 80 ft. per min. The method of mounting the cutters and of holding the stub arbor is shown in Fig. 2. It will be appreciated that the arbor must be rigidly held, in order to maintain the necessary accuracy.

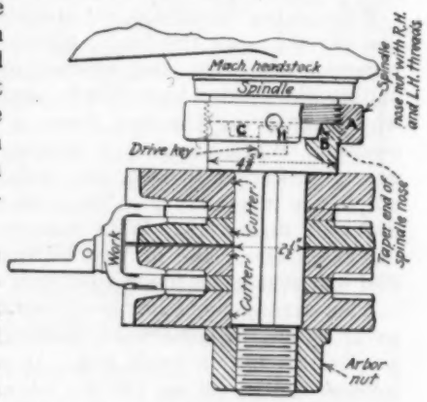


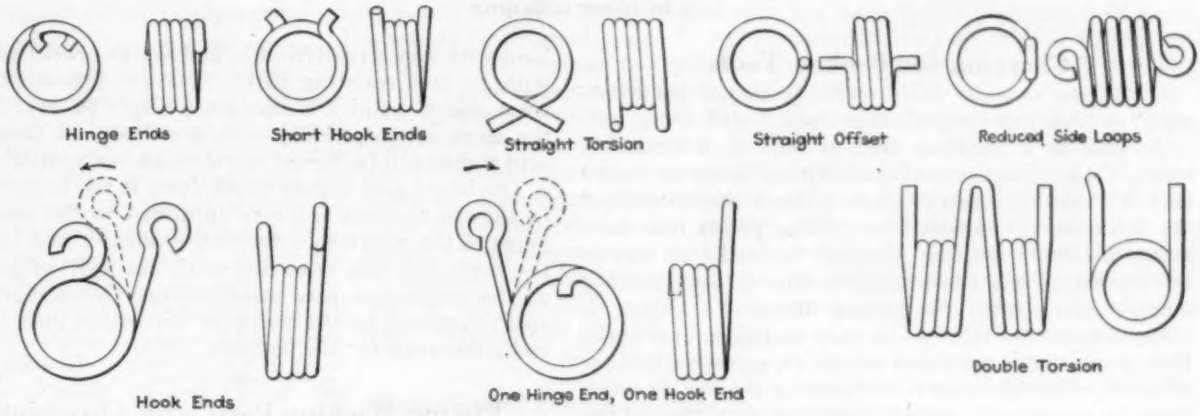
Fig. 2—How the arbor and cutters are mounted

The thread on the spindle nose being right hand, a left-hand thread was cut on the enlarged end of the arbor. A heat-treated nut *A*, of alloy steel, in which one-half the threads are right hand and the other half are left hand, is used to hold the end of the arbor against the spindle nose. The arbor is seated along the line *B* and is centered by the tapered boss *C*, to accommodate which, a corresponding depression is made in the arbor. Driving connection between the spindle and the arbor is by means of two keys, one of which is shown at *H*.

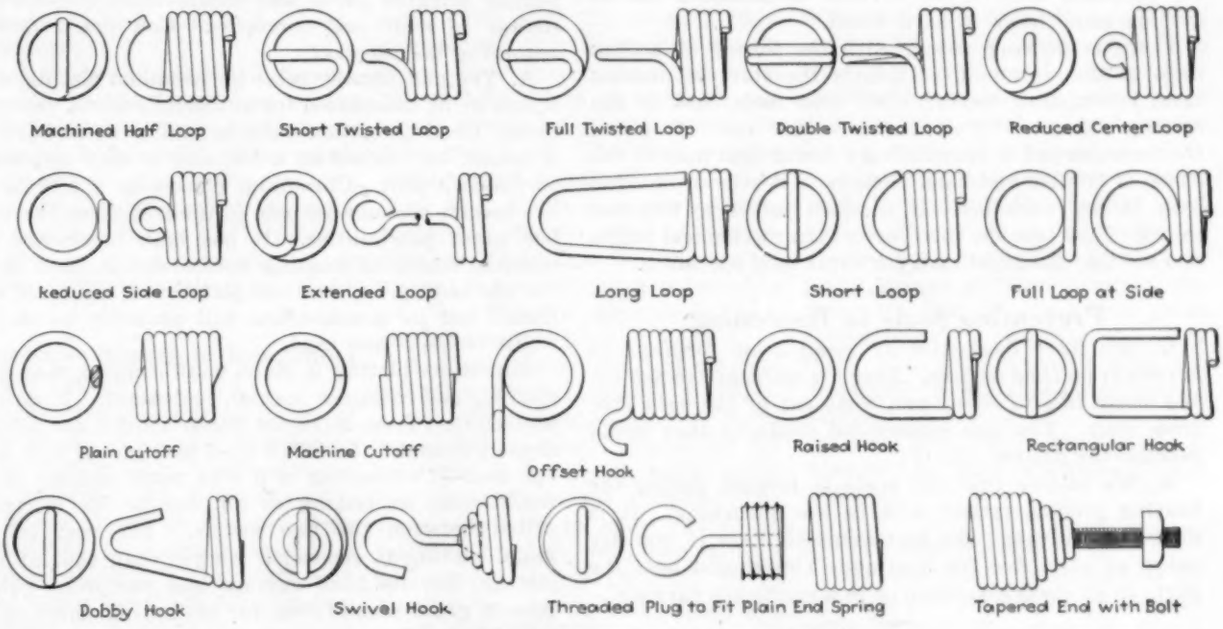
Design of Helical Springs

Typical Commercial Spring Ends

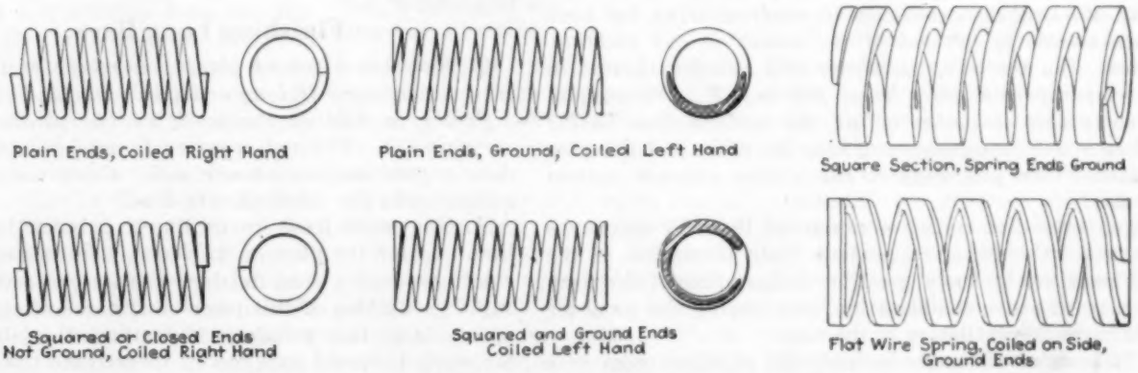
TORSION SPRINGS



EXTENSION SPRINGS



COMPRESSION SPRINGS


Plain Ends, Coiled Right Hand
Plain Ends, Ground, Coiled Left Hand
Square Section, Spring Ends Ground
Squared or Closed Ends
Not Ground, Coiled Right Hand
Squared and Ground Ends
Coiled Left Hand
Flat Wire Spring, Coiled on Side,
Ground Ends

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Charging for Broken Tools

Q. Do you consider it advisable to charge the workmen for broken drills and other small tools?

A. This is a question that is still in a debatable stage. Most management authorities, however, agree that it is not advisable to make a direct charge against the workmen for broken tools. Some plants that have many piecework drilling jobs sell the drills at cost to the workmen, but fundamentally this is only another manner of charging for broken drills.

Records can be kept in the shop toolroom, and where it is found that a workman breaks an excessive number of drills, either the man is unfitted for the job, or something is wrong with speeds, feeds, or with the fixture. A man who might do well on a rough milling operation, for example, may be too nervous to handle a job of drilling small holes in hard metal.

There is nothing wrong with the theory of selling tools to the workmen, as this is the start of making them contractors owning their own tools; but in the average shop, where contracts are out of place, the management is introducing a factor that may be the cause of trouble and hard feelings if it sells or charges tools to the workmen. It is much better to find the source of the trouble, then correct the mechanical faults and see that the right man performs each operation.

Preventing Scale in Hardening

Q. We have quantities of small steel forgings to harden from time to time. They are quenched in fish oil. We would like to have them come out of the bath free from scale. Can you recommend anything that would produce the desired effect?

A. We believe that the scale is formed during the heating process rather than in the quenching. It is difficult to prevent the formation of scale if you are using an open fire for heating. You should heat the parts in an electric furnace or in a muffle gas furnace.

Eliminating Pickling Fumes

Q. We have done considerable experimenting, but have been unable to get rid of the fumes in our pickling room. We are using sulphuric acid solutions heated to a temperature slightly below 200 deg. F. We wish to remedy this condition before the cold weather begins when it will be necessary to keep the doors and windows closed. Can you suggest the proper exhaust system to use?

A. Instead of trying to pump out the acid vapors we suggest attempting to prevent their formation in the cold weather by keeping up the temperature of the room to a point above condensation, and forcing the room air out through ventilators in the roof.

It is most advisable to have the pickling room in a detached shed. The roof ventilators should be of wood and of a type to prevent down draft. They ought to be built with non-corrosive nails, and the woodwork painted with an acid resisting paint. The air forced into the room should be at a temperature above 60 deg. F. If the doors of the pickling room are then kept closed the acid fumes will be forced out through the ventilators.

The heavy acid vapors which form if the temperature is allowed to drop are very injurious to the skin and lungs of the workmen. An ideal exhaust would be from the floor, but this does not work out well in practice as the exhausters give unsatisfactory service and are easily corroded by the action of the vapors unless especially designed for the purpose.

Plating Machine Parts with Chromium

Q. We understand that there is a new method of plating machine parts that makes them extremely resistant to wear and corrosion. Can you inform us regarding the process?

A. You undoubtedly refer to chromium plating, which is now being introduced for automobile parts, valves and tools. Good chromium plate is said to be so hard that it cannot be touched by a file, and is very resistant to corrosive action. Chromium plating is a process that has become commercial only in the last three years, and has great possibilities. It has been mentioned as a possible means of coating softer metals used in dies for die-casting. Chromium plate has a beautiful white finish, and its greatest use will probably be on parts where nickel is now used.

Chromium plating is much more complex than nickel plating, and requires special equipment. It does not protect steel from corrosion unless a thick and adherent deposit is made. In fact a steel part plated with a porous coat of chromium will rust more quickly than it would with no plating at all, due to the electrolytic action between the two metals. The cost of chromium plating is somewhat higher than that of nickel plating, but its hard surface and rustproof qualities give it great possibilities for protecting parts of commercial machines.

Finishing Long Bars

Q. We have a job of planing numbers of thin steel bars measuring 5 ft. long and 4 in. wide, and experience difficulty in holding the work on the planer without springing it. The cut required is only enough to produce a good surface on one side. Could we use magnetic chucks for work of this kind?

A. The work looks to us like a grinder job rather than one for the planer. If you require merely a light cut to produce a good finished surface you could obtain rapid production of this piece on a standard commercial open-side surface grinder. If you have the job as regular work it would pay you to investigate the grinding possibilities. Long magnetic chucks are provided for this class of machine.

Technical Abstracts

Continuous Oven Equipment

There are four distinct steps in converting plants for automatic or continuous production. It is first necessary to tabulate all the present production, sales consumption and inventory data in a thoroughly detailed fashion. Next should be studied similar manufacturing processes in other plants using the traveling type of equipment.

The information thus obtained can be used to map out production curves and schedules for the converted plant. Finally, in purchasing the necessary equipment, the best should be chosen and it should be designed to handle the range of sizes of a product, of which there is the greatest quantity.

It is uneconomic to buy a furnace that will handle 5 per cent of the product which happens to be twice as big as 95 per cent of the goods manufactured. This equipment will be less efficient in handling the small sizes and it is better to "farm" out, if necessary, the 5 per cent. A. B. Greenleaf, in *Industrial Gas*. July, 1926, p. 7.

Progressive System of Rebuilding Freight Cars

In the Missouri Pacific Shops at Little Rock, Ark., the progressive system of rebuilding freight cars has been adopted. All necessary materials are stored at stations along the erecting track, each class at a separate station. The cars are moved along the track from station to station in applying the different classes of material. In the case of flat cars, a movement from one station to the next is made every 45 min. A cost check has shown a saving of 38 per cent over the old method of delivering all the material to each car and keeping the car stationary during the time of rebuilding. Facilities have been provided for handling material promptly and for eliminating hand labor wherever possible. The total man-hours per car per day are 38.4 though it is felt that this can be reduced by dropping three men from the stripping gang. A Dayton spike driver for nailing car decks has been ordered, and when it is put in service another man can probably be dropped.

One of the features of the system is a progress chart carrying a continuous roll of drawing paper 50 yd. long. The chart will permit two years' performance to be recorded thereon, visualizing complete data as to in and out dates, and clear indications of what departments have been responsible for any delays incurred during the shopping period.—*Railway Mechanical Engineer*, July, 1926.

Higher Speed Racing Engines

Smaller and higher speed engines seem to be the tendency in racing cars. The Itala Co., Turin, Italy, announces a 12-cylinder engine with bores approximately 1.8 x 2.16 in. to run at 8,000 r.p.m. at which the car speed should be a trifle over 130 miles per hour. The total cylinder displacement is but 67 cu.in. The block is a single aluminum casting containing the two rows of 6 cylinders each at 60 deg. Steel liners are pressed in while the block is heated in oil. The 24 valves are operated by a single camshaft with 12 cams.

A Roots blower delivers air into cylinders through special ports instead of to carburetors. A front wheel drive is used, bringing the car very low, the maximum height being but 33 in. from the ground. The wheelbase is 98 in. and tread 47 in. while the weight, including battery and starter, is only 1,210 lb. W. F. Bradley in *Automotive Industries*, p. 96, July 15, 1926.

Arc Welding at the General Electric

Arc welding has been used in regular manufacturing work at the different works of the General Electric Co. for several years, with marked success.

Tanks for transformers, regulators, metering equipments, conservators, transformer breather pipes, treating and dipping tanks, trucks, racks, and bushing adapters are now being arc-welded. From several years' experience in making oil-tight joints and seams such as are required on transformer work it has been found that arc welding is about 15 per cent cheaper than riveting and 20 per cent cheaper than gas welding.

Motor frames made from $\frac{3}{8}$-in. steel plate, rolled and welded by an automatic machine, have displaced the steel castings. Laminated polepieces are being welded after assembly to prevent their creeping while being drilled and tapped. Commutator shells made of stamping steel are assembled by welding, the weight being much less than that of cast shells and all machine work being eliminated.

Generator stator frames that were formerly made from castings are now fabricated from steel plate and arc-welded. The saving from this change is considerable. Large steel castings for turbine and other work are now being saved and made usable by the use of arc welding.

A great many armature shafts used throughout the factory that have become worn at the journal or at the coupling or pulley fit are now being welded without stripping the armature, thereby effecting a great saving, which is rather hard to estimate. In many cases a complete armature is reclaimed by merely building up the shaft. This work has been done automatically—M. A. Atuesta, in July *Machinery*, page 854.

Better Bolts Needed

The principles of good machine design are all violated in the common machine bolt according to O. D. North, who points out the sudden and sharp cornered section under the head and the series of circumferential notches, or threads, where the stress is greatest. With these unavoidable handicaps it seems necessary that there be greater care in the selection of materials and that heat treatment be resorted to where stresses, either constant or intermittent, are to be met and counteracted. Where great dependence must be placed on bolts, they should receive much more careful consideration than has been the case in the past.—The *Automobile Engineer*, p. 252, July, 1926.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Pitfalls in Foreman Training

FOREMAN training is "in the air." And when any subject is "in the air"—misinformation and misunderstandings abound. The same was true when scientific management was "in the air." And then, as now, hot air and bunk were altogether too prevalent.

One difficulty is that in most of the meetings that discuss foreman training and foreman responsibility, the foreman himself is conspicuously absent. He is all too frequently talked about and relegated to this or that niche, by men who never have, and never could, fill his job satisfactorily. Questions as to whether he is a department manager, a supervisor, or a "come-on" for his gang, occupy hours of valuable time at conferences. Personnel men can be of great value in any plant. But unless they know the foreman's job from actual experience, it is hardly fitting that they should tell him what he ought to know and do, and treat him as a specimen under a microscope.

The average foreman is about as good as the management and organization will permit. That there is room for improvement, every good foreman will admit. But resentment and havoc are sure to follow some of the attempts now being made by well-meaning men who do not know the foreman's real problem.

If the average foreman were not capable and loyal many of our shops would go to pot in short order. Good foremen are anxious to improve in every way. But the desired results will not be secured by treating them as a lot of school boys or allowing theorists to consider them as "cases," to be shaped in some special mold.

Is There a Field for Plain Machines?

EVER since we began to make additions to the plain engine lathe, of say twenty-five years ago, we have had men who still prefer the plain lathe for this class of work. While admitting that quick change gear boxes save time in securing different feeds, they object to paying for them when, in their particular work, they consider them entirely unnecessary. They do not want the old lathe with its inadequate power, but they do want to be able to buy a lathe without any frills, if in their judgment, it suits their purpose as well or better than the other.

The plain machine has long had its advocates, not only on account of price but for its simplicity from the operation point of view. Then, too, the rigidity is a point to be considered, for unless compound rests are needed, the extra joints between sliding parts offer an opportunity for wear and spring.

It is quite possible on the other hand that the market for plain machines is too small to warrant building both kinds. In that case the cost might easily equal the standard product. There is also a contention on the part of some builders that the buyer should consider the resale value, although this is hardly a valid argument for buying a machine that is not just what you want.

The real demand and the sales resistance must guide the builder in his decision as to whether to build plain machines, or to stick to one design, with all the latest features.

The Production Bonus

DIFFERENCES of opinions as to the justice of wisdom of the bonus crop up on every side. Some consider that the bonus should be part of the wage or salary and that extras should be tabooed. Others find them very helpful in providing an incentive that brings out the extra effort which makes the difference between "fair" and "good" results.

The opponents of the bonus frequently clinch the argument by demanding that if gains are shared with foremen or workers, losses should also be shared.

It seems to be generally understood that there is a certain salary or wage that must be paid to secure services of any kind, and that if the service falls below the minimum required, dismissal is the only remedy. But it is also being conceded in many quarters that it is not only proper but profitable to use the bonus as a means of securing better service. And it should be remembered that a production bonus has nothing to do with the profits of the concern, but only with the increased production secured by the effort of the individual or of the group to which he belongs. And men only expect a return for their own efforts.

There are many bonus systems in use. Some are simple and others quite complicated. Some take into consideration punctuality, steadiness, production, cost reduction and suggestions. Much depends on the size of the plant, the product and conditions generally and bonus systems should be made to suit conditions. Once installed they should be carried through without vacillation, even if the manager does get palpitation of the check book at the size of the bonus paid. If the system is rightly installed, a look at the net savings should restore his equanimity.

Shop Equipment News

"Natco" Hydraulic-Feed, Multiple-Spindle Drilling Machine

The National Automatic Tool Co., Richmond, Ind., has placed on the market the hydraulic-feed, multiple-spindle drilling machine illustrated in Fig. 1. The machine was designed to meet the demands of maximum production on a quantity of relatively large holes to be drilled. It has a capacity for drilling 12 1-in. holes in cast iron at 0.010 in. per rev. feed, and 60 ft. per min. peripheral speed. This production requires a pressure of 8 tons at the point of the drills.

In Fig. 2 is shown the Oilgear pump and other mechanism for supplying the feed and rapid traverse to the head. The control is automatic. Movements of the head in both directions are limited by means of adjustable dogs on the plate provided at the right side of the machine. Practically an unlimited number of cycles can be obtained.

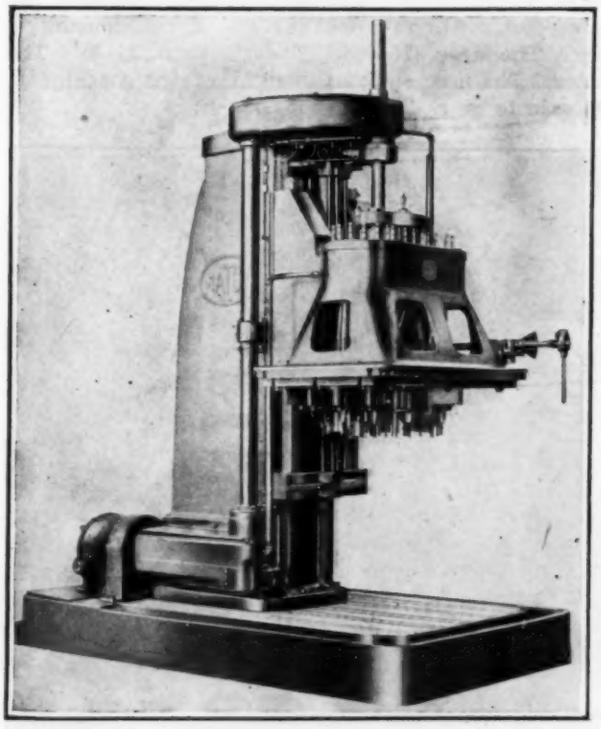

Fig. 1—"Natco" Hydraulic-Feed, Multiple-Spindle Drilling Machine

The machine is designed with centralized control. Two levers are provided on the right side of the head within easy reach of the operator. One lever starts the head cycle, which is later controlled by the adjustable dogs. The other lever is an emergency one and is used to throw the head into reverse. An indicator is provided that shows the setting necessary to obtain the various head movements. By means of the first lever the head can be made to enter either one of the two predetermined feeds, rapid traverse in either direction, or to remain neutral as desired.

Four types of head with various combinations of drilling spindles may be used with this machine. The various head dimensions are: 22x38 in., 24x40 in., a 30-in. round head, and a 40-in. rail head. The 24x40-in. and the 30-in. round heads have either 2½- or 3-in. universal joints, and are capable of drilling 10 1¼-in. holes in cast iron at 0.011 inch per rev. feed, and 60 ft. per min. peripheral speed. All heads have a long bearing on the column, so that when the spindles are located at the extreme outside edge of the drilling area, a pressure angle of only 30 deg. results. All heads are arranged with independent change of speed to each spindle. By means of pick-off gears practically any desired spindle speed within the capacity of the machine may be obtained.

The base of the machine is heavily ribbed both lengthwise and crosswise, and is designed to support the column without distortion under the heaviest load. It weighs about 8,400 lb. The working surface of the table is 53x39 in. Five T-slots are provided for clamping fixtures. A 4-in. channel surrounds the work surface and is used to catch the coolant and return it to the reservoir, which is located in the base.

The column of the machine is made exceptionally heavy in order to prevent deflection under heavy load. It weighs about 5,300 lb. The cross section of the metal varies from 1 to 1¼ in. The column itself is of the box-section type, measuring 37x22 in. The ways that support the head have a cross section 3½x2½ in. and are 22 in. apart outside to outside.

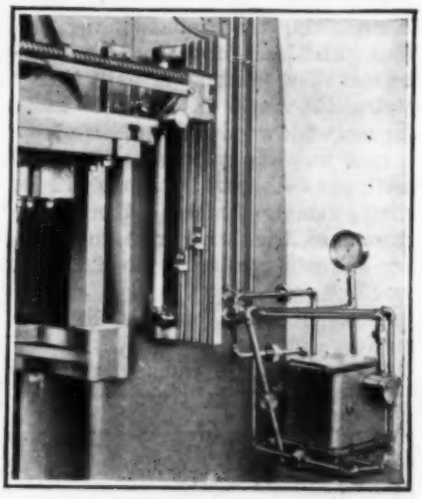

Fig. 2—Hydraulic-feed mechanism

Power may be provided through either belt or direct-motor drive. The latter is shown in the illustration. A 30-hp. motor is required to drive the machine. The power is transmitted through a horizontal shaft mounted on ball bearings and carried in a housing on the left side of the column near the base. Heat-treated bevel gears connect this shaft with a vertical inclosed shaft that transmits the power to a train of spur gears in the gear box mounted on the top of the column. These gears in turn bring the power to the head-shaft drive. All shafts and rotating parts are ground, and are made of alloy steel for greater strength.

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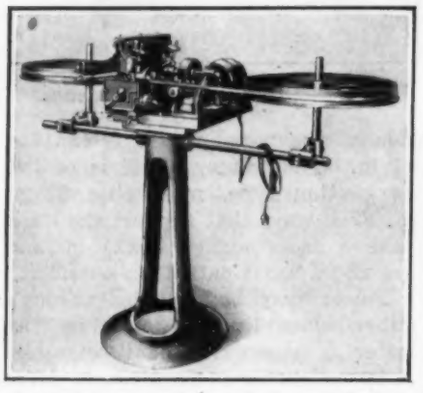
The machine is equipped with the cascade oiling system, and the horizontal drive shaft housing forms the oil reservoir, from which the oil is pumped to the gear case located at the top of the column. From there the oil flows by gravity to the head gear chest, then returns to the reservoir.

The machine weighs approximately 15 tons.

Wardwell Bandsaw Filing, Setting, and Jointing Machine

The Wardwell Manufacturing Co., 110 Hamilton Ave., Cleveland, Ohio, is marketing the bandsaw filing, setting, and jointing machine illustrated. The machine is built in two styles, the model K being intended for use with woodworking saws from ⅛ to 2 in. wide and having 2 to 15 teeth per inch, and the model K2 for spring tempered metal cutting bandsaws ⅛ to 2 in. wide with any number of teeth per inch up to 26. The machine is equipped with a double-pull positive feed, and is fully automatic.

Two adjustable cams working in unison alternately tighten and release the saw while it is being filed, set, and then moved on to the next tooth. Another cam connected to the main drive shaft raises the file slide frame at a slight angle from the vertical so as to give an oblique movement to the file as in hand filing, and thus to allow the file to enter and leave any hook on the saw teeth. Adjustment is provided for the length of stroke and for the amount of stock filed from the base of the teeth. An elevating screw raises or lowers the saw at the point of filing, and another at the point of setting.



Wardwell Bandsaw Filing, Setting, and Jointing Machine

The setting mechanism is governed and timed by an eccentric roller geared to the main drive shaft. As the file sharpens the tooth, the set-up points set another tooth. This setting device runs on a steel bearing and can be moved back and forth on a sleeve so as to bring the point in line with the teeth on saws of different pitch. The adjustment is made while the file is resting in a tooth. The point can be adjusted to set as much or as little as desired, so that the proper clearance is obtained behind the cutting edge of the teeth. The operation is performed at the rate of 70 teeth per minute.

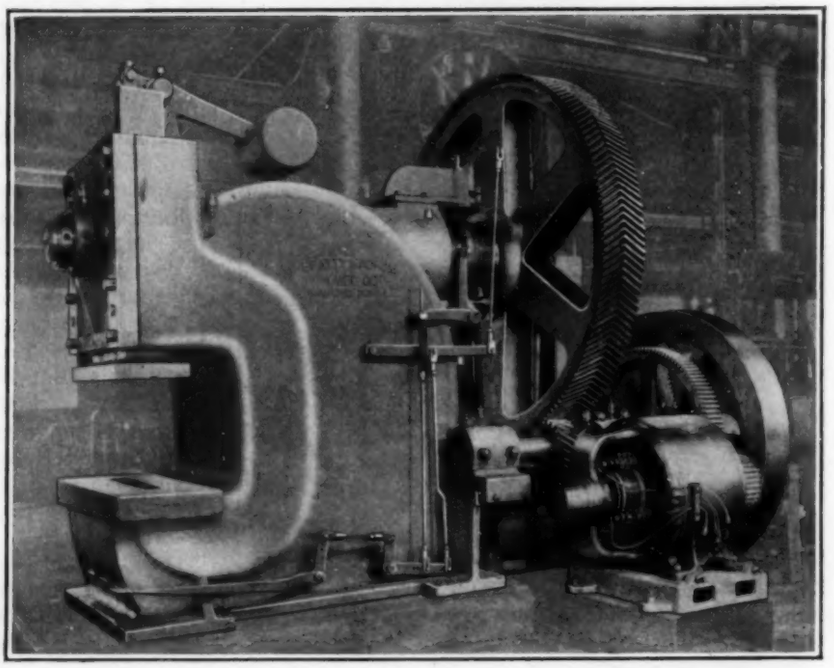
The machine weighs 78 lb. equipped for belt drive and without the pedestal illustrated. It may also be furnished with a direct-connected a.c. or d.c. motor of ¼ hp. The machine and motor are mounted on a cast-iron base, and the equipment weighs approximately 145 pounds as shown in the illustration.

Beatty Heavy-Duty Single-End Punch, No. 12-A

The No. 12-A heavy-duty single-end punch illustrated, is being marketed by the Beatty Machine & Manufacturing Co., Hammond, Ind. The machine is intended primarily for the punching of splice bars and tie plates. It has a capacity of 750-ton ram pressure and the frame is massive to withstand this load.

The drive is from an electric motor through straight spur gears and then through a herringbone pinion and gear. Both the pinion and the gear are made of cast steel, and each has a 12-in. face. The large gear is 96 in. in diameter. The use of this type of gear is said to be a departure from standard practice. All main shaft bearings are bronze bushed and the ways for the slide or ram are bronze lined. The main shaft is square at the clutch so that the clutch has a 4-sided bearing on the shaft and does not rely upon keys to drive. The foot control for the clutch can be plainly seen in the illustration.

The table measures 21 x 53 in., while the face of the slide is 15 x 37 in. The depth of the throat from the ram to the face of the housing is 15½ in. The stroke is 2½ in. The shipping weight of the machine is 72,000 pounds.

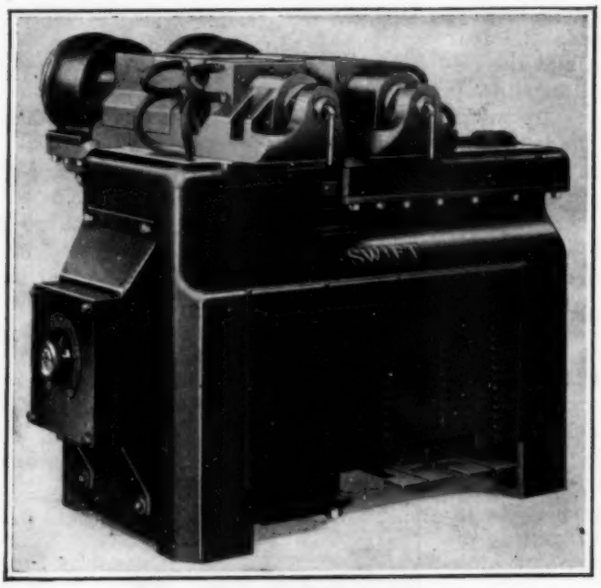


Beatty Heavy-Duty Single-End Punch, No. 12-A

Shop Equipment News

Swift Electric Welder

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has taken over the selling rights of the electric flue welder, illustrated, that is being manufactured by the Swift Electric Welder Co. The machine was designed for safe-ending of flues and for welding operations in reclaiming small pieces. With proper dies it can be used for any kind of butt welding. It may also be used for welding round or bar stock or for annealing, upsetting, heating, stretching, and the like.



Swift Electric Welder

The welding clamps are adjustable and are said to be flash and slag proof. They slide on hardened steel guide plates in order to minimize wear and are actuated by a foot-operated air cylinder, so that the operator has both hands free to handle the work. This pneumatic control consumes about three-fourths of a cu.ft. of air at approximately 80 lb. per sq.in. pressure for each weld.

Two pair of dies are used for each set. One set of dies handles work on both 2- and 3-in. tubes. On larger work a separate set of dies is required for each size of flue. All the dies are water cooled and have hardened steel guide plates to prevent wear. A pressure cylinder is used to push up the work. It may be connected to either an hydraulic accumulator, an oilgear pump or a hand-operated oil-jack. A pressure of 800 lb. per sq.in. is required for welding 6-in. tubes, and for smaller work the pressure is proportionately less. For each welding cycle 0.6 gal. of fluid is required to operate the dies.

The welder is operated by means of a remote control system that consists of a contactor panel separately mounted and operated from a lighting circuit by a push button switch on the welder. In this way the power is entirely removed from the welder except at the instant of making the weld, and thus the danger of shock to the operator is reduced. The unit can be supplied for operation on 220-, 440- or 550-volt primary current, preferably of 60 cycles. The primary circuit is air-cooled, while the secondary circuit, dies and die blocks are water - cooled. The machine is rated at 150 kva. at 85 per cent power factor.

This welder has a capacity for boiler flues and superheater tubes in any size up to 6 in. in diameter.

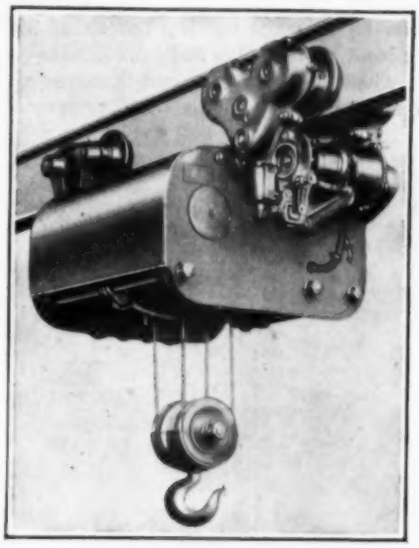
"Lo-Hed" Electric Monorail Hoist

Six electric monorail hoists, ranging in capacities from 3 to 12 tons, are announced by the American Engineering Co., Philadelphia, Pa., as additions to its line of "Lo-Hed" hoists. Each of the hoists is made in types for bolt suspension. A hand-geared trolley or a motor trolley with cab control can be provided. Open cabs are supplied for indoor use and closed cabs for outdoor service. The hoists can also be furnished with push-button control, remote control, or foundry-type control, as desired.

These hoists, which are designed as "Class J, Lo-Hed" electric hoists, embody the same principles of design that characterize the other models of Lo-Hed hoists, with such additional features as are made necessary by the higher speeds at which they operate and the heavier loads they are designed to handle. Rated capacities are 3-, 5-, 8-, 10- and 12-ton, so that the complete Lo-Hed line now includes hoists from ½- to 12-ton capacity..

In all Lo-Hed hoists the drum and motor are placed on opposite sides of the I-beam track, so that the load block can be drawn up between them until it almost touches the rail. With this design, all the available headroom is utilized, and these hoists are enabled to handle larger loads and to stack goods higher than would ordinarily be possible.

The hoist operates on standard I-beams, through switches, and around curves. The trolley wheels are mounted on Hyatt roller bearings and ball thrust bearings are placed between the wheels and the trolley frame. The wheels on both sides of the I-beam are driven through straight spur gears, and the hoist moves easily along the rail.



"Lo-Hed" Electric Monorail Hoist

The trolley trucks are swiveled in order to negotiate curves of short radius.

The ball-bearing hoisting motor is totally inclosed, and it drives the drum through spur gears that run in oil. Hyatt bearings are provided on the shaft. The working parts are accessible for inspection by removing the cover of the hoist. The motor and pinion can be removed as a unit without removing the gear cover or draining the oil from the

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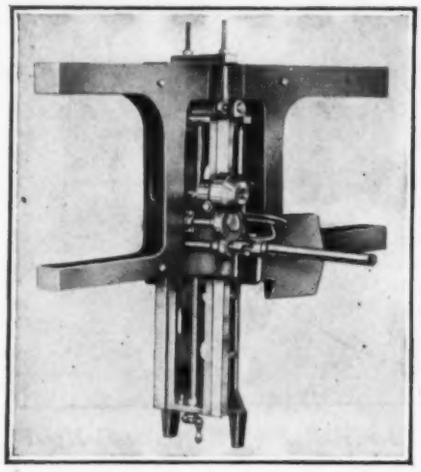
gears. A swivel hook on the load block makes it easy to turn the load and to guide it.

Safety features include a factor of safety of five in the design of the hoist. An upper-stop limit is provided as well as a powerful quick-acting brake that is automatically applied when the current is turned off, either accidentally or intentionally. This brake stops all movement of the load without drift.

Micro Portable Locomotive Frame Jaw Miller

The Micro Machine Co., Bettendorf, Iowa, is marketing the portable frame jaw miller illustrated. The machine is intended for milling straight smooth surfaces against which the locomotive shoes and wedges bear. It is claimed that this machine eliminates the old filing, chipping and hand grinding methods and produces a maximum bearing surface in a minimum time. It mills the full length of the jaw and finishes the top radii complete. The machine has an extreme milling length of 33 in. and an extreme width of 7 inches.

The sliding cutter head is mounted on a heavily ribbed main frame



Micro Portable Locomotive Frame Jaw Miller

which is 40 in. long and 11½ in. wide. A take-up gib is provided to correct for wear. The spiral cutter itself is held in bearings that are in turn mounted in eccentric holders for adjusting the depth of cut. Locking screws are provided to hold the adjustment. The bearings are kept in line by means of a double-pinion shaft which is also used to increase the eccentric throw. This shaft is actuated by means of a wrench applied on the operative side.

The vertical feed of the cutter head is accomplished by means of a threaded worm gear, driven by an intermediate gear and worm and wheel. A handle for lowering the cutter head is provided at the bottom.

The machine is mounted in the frame by drawing it tight against the horizontal top section of the frame jaw with a clamp. The lower portion of the machine is supported with an adjustable aligning bracket and screw placed between the rear side of the main frame and the opposite jaw face. The machine is driven with a 300-r.p.m. air motor mounted on a stand and driving through a universal joint shaft.

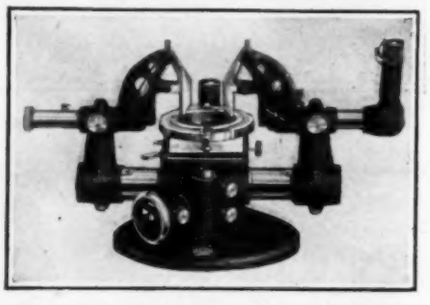
"Zeiss" Inside Measuring Attachment for Horizontal Optimeter

An inside measuring attachment for the Carl Zeiss horizontal "Optimeter" is being marketed by George Scherr Co., 142 Liberty St., New York, N. Y. The Optimeter was described on page 560, Vol. 61, of the *American Machinist*. The instrument is intended to facilitate the work of measuring bores, both absolute and relative.

The left-hand bracket of the attachment is clamped into the tailstock of the Optimeter, which has coarse and fine adjustment, while the right hand bracket is attached to the optical tube. These brackets contain the pivots for the adjusting and measuring jaws. One end of the left jaw bears against the tailstock, while that of the other jaw bears against the feeler of the standard Optimeter tube. The opposite ends of both jaws are brought into contact with the bore of the ring or gage being measured.

Since the Optimeter measures by comparison, the nominal diameter must be previously set by a master gage. This may be formed by a snap gage built up from gage blocks or merely by such blocks. In the former case, the outside feeler points for measuring the bore are directly set to zero by the faces of the snap gage. In the latter case, a gage block equal to the nominal size less the sum of the lengths of both feeler points is placed between the inside points and then the scale is adjusted to zero. This last procedure involves a reversal of the direction of the measuring pressure and a switch lever is provided for this reversal.

The ring or snap gage may be placed on the table which is raised until the measuring points are within the bore. The deviation of the size of the gage from the nominal size may then be observed in the Optimeter tube. It is, of course, necessary to move the ring gage until the maximum diameter has been located. This shifting is accomplished by the compound table motion, since the lower slide floats in balls in the direction of the measuring pressure while the upper side is traversed crosswise by means of rack and pinion. The table is vertically adjustable to check the size of the bore at various heights or for taper. A swivel motion of the table is also provided in order to obtain a correct adjustment to a snap gage built up from gage blocks. This motion does not interfere with the measuring action. This arrangement permits of setting to a minimum diameter across the opening of the snap gage. Since standard snap gages may be placed



"Zeiss" Inside Measuring Attachment for Horizontal Optimeter

on the table, they may be readily inspected for size and parallelity of the measuring faces.

Both the feeler points and the jaws are readily interchangeable. Special feelers and jaws may be used for small bores and for the measuring of such work as ball bearing races. It is claimed that a careful operator will work within an accuracy of 0.001 mm. or 0.00004 inches.

The maximum height of ring gage accommodated is 1¾ in., while the maximum diameter accommodated is 3½ in. The minimum diameter with heavy arms is 1$\frac{3}{16}$ in., while with light arms a diameter of $\frac{33}{64}$ in. can be measured.

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Olsen Special "Last Word" Hardness Tester, Nos. 1 and 2

The Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., is marketing the Nos. 1 and 2 special "Last Word" hardness testers illustrated in Figs. 1 and 2, respectively. The No. 1 machine was designed primarily for use in testing soft material and soft sheet metal, such as brass and aluminum,

Fig. 1—Olsen Special "Last Word" Hardness Tester, No. 1

and for testing bronze bushings or other parts made from soft metal. The No. 2 tester is for both hard and soft materials, including sheet metal.

In the No. 1 machine, instead of applying a 500-kg. load on a 10-mm. ball, a dead weight load of 12.61 kg. is applied to a ⅛-in. ball. The apparatus consists of this dead weight, together with the mechanism for applying it through the ball to the material to be tested, an anvil for holding the test specimen, and an indicator for measuring the depth of impression. The measurement of the depth of impression is considered more accurate in the case of soft metals than the usual way of measuring the width, as in ordinary Brinell tests.

The anvil is first adjusted so as to provide clearance for inserting the specimen. After the specimen is inserted between the anvil and the ball, a knurled head at the right-hand side of the instrument is turned 90 deg., so that the ball rests directly upon the specimen. By turning the knurled head another 90 deg., the weight of 12.61 kg. is gradually placed upon the ball, which then penetrates the test material. The depth of impression is read on the indicator after the weight has been relieved by turning the knob back to its former position.

The operation of the No. 2 hardness tester is somewhat similar to that of the No. 1 apparatus. The anvil is set for the thickness of sheet metal or material to be tested, and the specimen inserted. A small knurled head at the front of the machine is turned so that the ball and anvil, with the measuring indicator, is placed in contact with the specimen. The load is applied by dropping a hand lever at the front top of the machine. The dial indicator is set at zero before applying the load and again read after the load is removed. As before, the depth of impression is read, and by means of

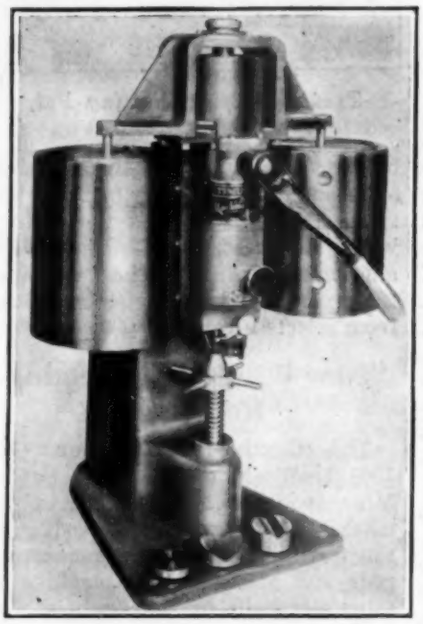

Fig. 2—Hardness Tester, No. 2

tables the corresponding Brinnell hardness number can be obtained. The weights are suspended from two sides of a crosshead and are removable. Hence, the machine may be used for applying a low load on soft sheet metal or a high load for testing steel or harder sheet metal.

A diamond can be supplied in the shape of a ⅛-in. ball, if desired, in place of the standard steel ball.

"Quick-Clamp" Milling Vise

The "Quick-Clamp" milling vice illustrated is being marketed by the Universal Standard Sales Co., 500 Murphy Bldg., Detroit, Michigan. The vise is of the automatic operating type, inasmuch as the locking

"Quick-Clamp" Milling Vise

mechanism engages in whatever position the pressure is applied to the jaws.

The greater the pressure applied to the jaws, the more firmly does the locking mechanism function. The movement of one jaw is actuated through a rack and pinion and a short hand lever. The locking mechanism consists of three pins carried on the pinion member that engage a slotted disk that is actuated by the lever handle. When resistance to movement is applied against the pinion, the slotted disk wedges the pins against a stationary wall. Increase of resistance against the pinion only tends to wedge the pins tighter. The wedge is released by slight pressure on the lever in the opposite direction.

Philadelphia Speed Reducer, Type A-X

The Philadelphia Gear Works, Richmond & Tioga Streets, Philadelphia, Pa., have placed on the market the type A-X speed reducer illustrated. This unit was especially designed for conditions that require an overhung load such as that coming from a pinion or sprocket on the worm gear shaft. In order to take care of such an overload condition the shaft is of large diameter and is mounted upon roller bearings.

The worm and shaft are integral

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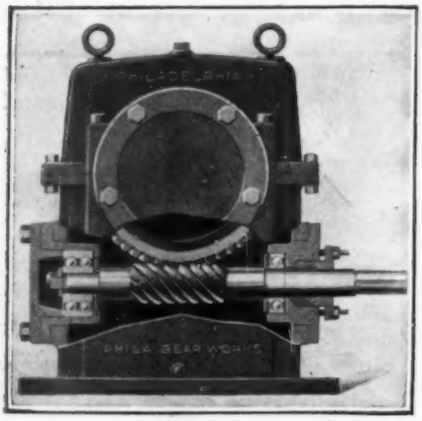
and are made from high grade alloy steel. The worm threads are hardened then ground so as to eliminate any hardening distortion and to assure positive contact with the teeth of the worm gear. The worm gear consists of a chilled cast-bronze rim,



Philadelphia Speed Reducer, Type A-X

shrunk on and pinned to a cast-iron center. The worm gear is balanced and is tested for proper tooth contact with the worm.

The illustration shows the worm mounted upon ball bearings. Roller bearings are also furnished to meet special conditions.

The ball or roller bearings on the worm shaft are protected from grit and other foreign matter by means of oil filters. The filter consists of a very fine mesh bronze screen locked between two bronze plates, and it is set at each end of the worm shaft close to the bearings. With this filter arrangement a constant circulation of oil takes place without any dirt being carried into the bearings.

The type A-X units are available for various horsepowers up to 200, and in practically any desired ratio of reduction. The worms may be placed above the gear, below the gear, or in a vertical position.

Trent Electrical Melting Pots, Portable

Electrically heated melting pots of 10 and 20-lb. capacity have been added to the line produced by Harold E. Trent, 259 North Lawrence St., Philadelphia, Pa. The 45-lb. pot was described on page 928, Vol. 64, of the *American Machinist*. The 10-lb. pot is illustrated here.

The pots are suitable for melting babbitt metal, solder, lead, tin, and other metals with low-temperature melting points. Three temperature stages are available by means of three plugging positions. The contact prongs are protected from abuse by being inset in the body of the pot. A special plug, connecting wire, and standard socket plug are provided for connecting the unit to any a.c. lighting circuit of 110 or 220 volts.

The pots are fitted with spouts and two handles to facilitate pouring the metal. One of the handles is also used for carrying the pot. The

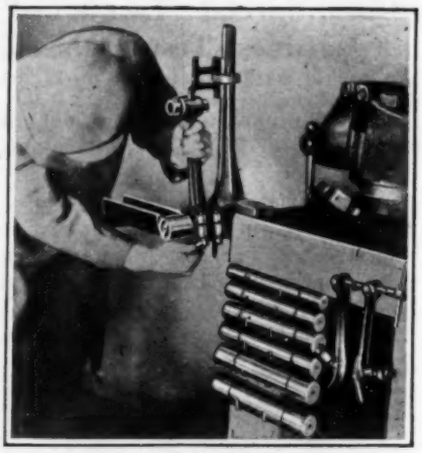
Trent Electrical Melting Pot, Portable, 10-lb.

heating elements are fully insulated by means of a refractory material between the elements and the casing, which is sheet steel finished with aluminum paint. The crucible, flange, and spout are cast in one piece from selected iron.

"New Wilkie" Connecting-Rod Gage

The Continental Machine Co., 1301-3 Washington Ave., South, Minneapolis, Minn., is placing on the market its "New Wilkie" rod gage for testing and aligning connecting rods and pistons. The machine is especially built for garage use, and is designed to fasten to any bench. In the accompanying illustration it is shown with a connecting rod in place. The rod stands vertically on the arbor for the bend test, and any error can be sighted between the testing plate and the wrist pin.

The universal bender that is furnished with the machine is claimed to take the bend out of any rod by simply tightening a screw. Twist is removed in a similar manner. A full set of ground arbors is supplied



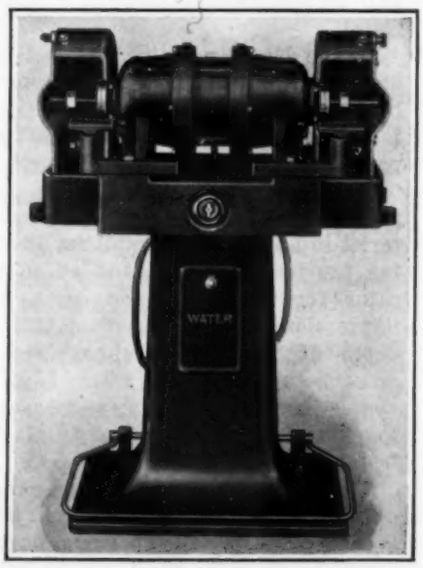
"New Wilkie" Connecting Rod Gage

with the machine. The method of seating the rod on an arbor is stated to be the only positive manner of securing accuracy in the test. All working surfaces of the machine are ground, and accuracy is claimed to a ten-thousandth of an inch.

"Safety" Foot Control for Tool Grinder

The Safety Emery Wheel Co., Springfield, Ohio, is equipping its tool grinders with a treadle for foot control of the machine. The machine starts when the operator steps on the treadle and automatically stops when he leaves the machine.

The grinding wheels are mounted directly on the motor spindle. In the unit pictured the motor operates



"Safety" Foot Control for Tool Grinder

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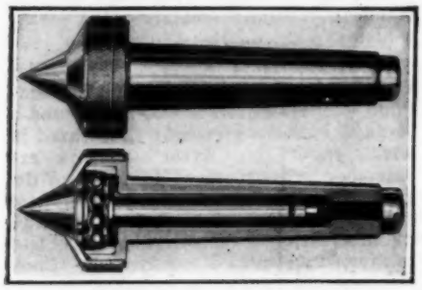
at 1,750 r.p.m., full load, and a 12-in. wheel is employed. Ample guards are provided for the wheels. The tool rests are adjustable in two directions.

Nielsen Ball-Bearing Lathe Center

Nielsen, Inc., Lawton, Mich., is marketing the ball-bearing lathe center shown in the accompanying illustration. Two features of the center are the long spindle bearing that is intended to remove any possibility of wobbling of the point, and the adjusting screw on the end that permits the taking up of any wear.

The ball bearings run in oil, and carry both the radial and thrust loads. They are entirely inclosed



Nielson Ball-Bearing Lathe Center

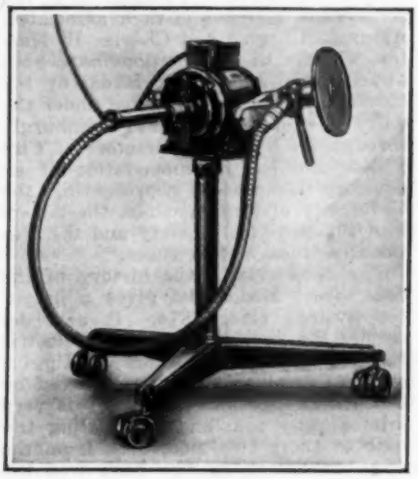
and protected against dirt. The center spindle is made of a high grade of tool steel and is hardened and ground. The centers are furnished in sizes from No. 1 to No. 7 Morse taper, inclusive. In addition to the standard make center three other shapes are supplied. These are: pipe center, wood turning center, and countersunk center. These centers differ from the standard center only in the shape of points.

Mall Portable Polishing Machine

The Mall Tool Co., 8389 S. Chicago Ave., Chicago, Ill., has placed on the market the pedestal type portable polishing machine shown in the accompanying illustration. The machine is intended for polishing curved or flat surfaces, but can also be employed for grinding, sanding, or rubbing operations.

The pedestal type of mounting enables the machine to be transported readily about the shop. The flexible shaft is furnished either with right angle drive as shown, or with a straight drive. The motor is 1 hp. operating at 3,450 r.p.m., and it swivels on the steel pedestal. The swivel has wide bearing surfaces for greater rigidity.

The disks are made of rubberized



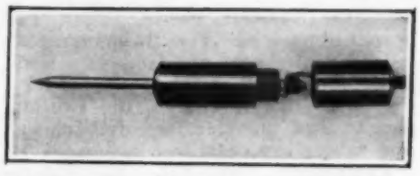
Mall Portable Polishing Machine

fabric, and are claimed to stand up under severe service. They are furnished in various degrees of flexibility to suit the requirements of the work. Three disks are supplied with the machine. A tool bracket on the side of the motor supports the disk when not in use.

Universal Heavy-Duty Test Handle

The Universal Test Equipment Co., 2939 N. Oakley Ave., Chicago, Ill., is marketing a heavy-duty test handle for use in testing storage batteries and other apparatus where a heavy current may be met.

The handle has a removable cap as can be seen in the illustration. It is made of a special insulating material that is claimed to be shock and moisture proof. The grip is 1 in. in diameter. A pointed steel prod, cadmium plated so as to be rust and acid-proof, extends 3 in. from the



Universal Heavy-Duty Test Handle

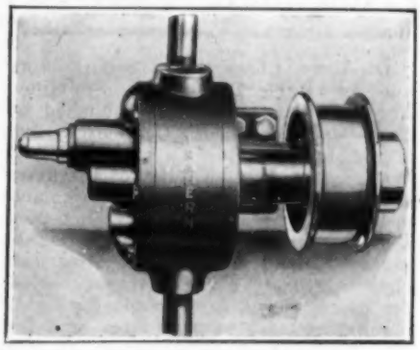
grip and is ¼ in. in diameter. This prod extends through the grip and the upper part of it is slotted for the insertion of any size wire up to No. 8 B. & S. wire gage. Almost any kind of wire desired can be used for leads and the change can be made very quickly.

The test handle measures 7 in. overall and can be supplied in pairs with or without 3-ft. flexible leads equipped with terminals for fastening on instrument boards.

"Trahern" Reversible Coolant Pump

The reversible coolant pump shown in the accompanying illustration has been placed on the market by the Geo. D. Roper Corp., Rockford, Ill. The pump is intended for use on metal-working machines to handle water, oil, or any cutting compound.

To relieve the pump of strain from the belt pull an extended bearing has been cast integral with the back plate. The pump is of the rotary geared type, and is said to deliver continuously a copious supply of



"Trahern" Reversible Coolant Pump

liquid. A relief valve is built into the face plate, and this valve acts as an unloader, automatically by-passing all excess flow from the pump.

The pump is especially designed for use on reversible machines, but is adaptable for any type of metal-working machine. It is made in four sizes with capacities ranging from 1 to 26 gal. per minute.

Spiral-Fluted Expansion Reamer, No. 717

The No. 717 spiral-fluted expansion reamer illustrated is being marketed by the Morse Twist Drill &

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Machine Co., New Bedford, Mass. It is said that the spiral flutes make it an easy free cutting tool, and if there is a longitudinal slot, keyway, or chamber in the hole the reamer does not catch or chatter. The reamer has long guides both at the

Morse Spiral-Fluted Expansion Reamer No. 717

top and bottom, and it is especially adapted for reaming piston pin holes. It is adjustable to a few thousandths of an inch oversize.

The reamer is made in sizes ranging from $\frac{3}{8}$ to $1\frac{1}{2}$ in. in diameter. The length of flute varies from $1\frac{7}{8}$ to $4\frac{1}{2}$ in., while the overall length varies from $6\frac{1}{2}$ to $12\frac{1}{8}$ in. The length of the pilot is 2 in., except for a few of the smaller sizes, where it is somewhat less.

Pamphlets Received

Die-Head Chasers for Self-Opening and Adjustable Die Heads. Simplified Practice Bulletin No. 51, published by the Department of Commerce and issued by the Bureau of Standards, Washington, D. C. A list of the associations, producers, distributors, and users of die heads that have accepted this practice is given. The standards are given in five tables: for American National coarse and fine-thread series, for special sizes, for threads for lighting fixtures, for railway sizes, and for pipe threads. A brief history of this phase of elimination of waste is given.

Is Credit Necessary in Export Trade? The National Foreign Trade Council, India House, New York City, has published in pamphlet form the addresses of E. B. Filsinger and D. W. Fernhout made on this subject before the Thirteenth National Foreign Trade Convention at Charleston, S. C., April 28-30, 1926. The booklet also contains a foreword by A. S. Hillyer, Chief, Commercial Intelligence Division, Bureau of Foreign and Domestic Commerce, Washington, D. C. The pamphlet gives a concise exposition of the present foreign credit situation, and indicates practical methods for the manufacturer at home to obtain information and govern his foreign shipments.

Steel Forgings, Carbon and Alloy. Industrial Standards No. 11 published by the U. S. Department of Commerce, Washington, D. C. The text is given in both English and Spanish and contains standard specifications for carbon steel and alloy steel forgings as adopted by the American Society for Testing Materials. The booklet contains twenty-two pages.

Two Norton Achievements. Published by the directors of the Norton Co., Worcester, Mass., in recognition of the achievements of two of their associates, Aldus C. Higgins and Charles H. Norton, who for their inventions have been awarded the John Scott Medal by the City of Philadelphia, Trustee under the will of John Scott of Edinburgh, through its Board of Directors of City Trusts and on recommendation of an advisory committee, representing the University of Pennsylvania, the American Philosophical Society and the National Academy of Sciences.

The book relates the history of the John Scott Medal and gives a list of the awards since 1874. It also describes the development of the electric furnace invented by Aldus C. Higgins and the grinding machine invented by Charles H. Norton. The story is very interestingly told and is a fitting tribute to these two men, both from the same organization, who have won the distinction of receiving this medal "distributed among ingenious men and women who make useful inventions," according to the terms of John Scott.

The preparation and execution of the book is very attractive. Sepia photographs of the two men and their inventions, and facsimiles of the medals and of the certificates accompanying the medals are included. The book is 8½x11 in. and bound in board covers.

Trade Catalogs

Automatic, Cone. The Cone Automatic Machine Co., Inc., Windsor, Vt., has issued a booklet containing fifty-four 6x9-in. pages in which its cone automatics are described and illustrated. The general construction and operation of the machine is first described. In the remainder of the booklet every part is pictured and described by means of reference letters. The parts are grouped according to working units, such as the cross slides, the tool slide, the turret revolving mechanism, etc. The booklet is intended primarily for service work.

Chucks. The Cushman Chuck Co., Hartford, Conn., has issued a new catalog No. 44 describing its products. It contains thirty-six 6x9-in. pages, and is well illustrated. The "Incomparable" independent chucks and face plate jaws, the geared scroll self-centering chucks, the new Tri-Plex chucks, the two-jaw chucks, and the Hartford drill chucks and arbors are described.

Controllers, Electrical. The Cutler-Hammer Manufacturing Co., 1266 St. Paul Ave., Milwaukee, Wis., has issued publication No. C-37, entitled "Industry's Electrical Progress," in which are described and illustrated various applications of C-H Automatic Controllers. The booklet contains thirty-six 6x9-in. pages and is bound with a stiff paper cover.

Micabond, The Modern Mica. Chicago Mica Co., Valparaiso, Ind., has issued a 24-page booklet describing its products. Micabond plate, moulding plate, tubing, and tape are discussed with illustrations of typical forms. Examples of typical applications are also given.

Milling Machines, "Rigidmil." The Rockford Milling Machine Co., Rockford, Ill., has issued a booklet entitled "Greater Milling Efficiency." It contains thirty-eight 8½x11-in. pages and is profusely illustrated. The entire construction of the machine and each and every unit is made clear by means of drawings, cross-sectional views and photographs. The operation of the standard machine and its attachments is also explained.

Planers, "Time Saver." The Niles Tool Works Co., Division Niles-Bement-Pond Co., Hamilton, Ohio, has issued a 16-page bulletin profusely illustrated in which its "Time Saver" planers are described. The various features of design are brought out, the operation of the machine is explained, together with its lubrication. Considerable attention is given to electrical equipment. Complete specifications are included.

Polishing and Buffing Machines. The Mitchell Engineering Co., Springfield, Ohio, has issued a 16-page illustrated bulletin describing its ball bearing polishing and buffing machines. Complete specifications are given for each machine.

Riveters, Bull. The Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has published bulletin No. R-204-A illustrating and describing Hanna bull riveters. The bulletin contains 36 6x9-in. pages, perforated for insertion in a loose leaf binder. The construction of the pneumatic operating mechanism is first described. Various types of riveting machines and applications are then discussed and illustrated. Numerous photographs and line cuts are used throughout. Specifications and engineering data are given.

Speed Reducers. The Philadelphia Gear Works, Philadelphia, Pa., has issued a new catalog on its Speed Reduction Units. This booklet tells of the advantages of speed reducers in general and gives facts, figures, charts and illustrations regarding the four types—spur gears, worm gears, spiral-bevel gears and herringbone gears.

Wheels, Light-Weight Wrought Steel. Carnegie Steel Co., Pittsburgh, Pa., has issued a small booklet describing the manufacture and specifications of its light-weight wrought steel wheels for freight car use.

News of the Week

Manufacturers and Engineers See Tests of Arc Welded Steel by Westinghouse

Results show welding 20 per cent stronger than riveting

More than a hundred representatives of structural steel concerns, technical societies, and steel trade publications assembled at the mechanical laboratory of the Carnegie Institute of Technology on July 28 and 29 to witness the tests of arc-welded steel sections made by the Westinghouse Electric and Manufacturing Co.

The girders and other test specimens were prepared by the Westinghouse company aided by the American Bridge Co. Twenty-one tests in all were made to determine the relative strength and characteristics of various typical structural sections when welded, as compared with specimens of riveted joints. The tests showed yield points and ultimate strengths from 10 to 20 per cent greater for the welded section than for the riveted joints of comparable construction.

At the luncheon given to the guests on Wednesday, W. S. Rugg, vice-president of the Westinghouse Electric and Manufacturing Co., announced the letting of contracts for the erection of two buildings on his company's properties, both buildings to be entirely arc welded. One of the structures will be a one-story building to be used as an engineering laboratory for the East Pittsburgh works, and the other will be a five-story mill-type building for use in the manufacture of transformers at the Sharon works.

Beginning of New Era

Mr. Rugg said that both buildings would mark a new era in steel history. The building at Sharon, when completed will be the largest rivetless steel building in the world, and the first practical application of arc welding to large buildings. It is the first building to have its members and joints especially designed for welding. Mr. Rugg stated that his company had retained for the purpose of developing this new field of arc welding Dr. G. D. Fish, consulting engineer of New York.

Dr. Fish brought to the attention of the guests that experiments and tests have proved that the arc-welded structural sections were stronger than those with riveted joints, and that a large percentage of steel can be saved. He said that at the present time the welded joints were being made stronger than actually needed, and that further experiment would enable engineers to tell just how far the welding can be cut down to develop the full strength of the beam. Eventually, he told the guests, the welded joint would permit the cutting down of the size of the beams, since in many cases at present the size of beam is determined by the strength required at the riveted joint.

Some of the visiting representatives also made a trip to the Westinghouse plant and viewed the application of the arc-welded joint to high-pressure tanks and to general shop work. The Westinghouse engineers maintain that the practical use of arc-welding in shop work is almost unlimited in its scope, and that any average shop can train workmen in the intelligent use of the arc to insure reliable welded joints. The company is now conducting a school for arc welders at its East Pittsburgh plant, where men from various companies are being trained in arc welding.

Among the visiting engineers at the tests were the following: G. Lewis Taylor, chief engineer, McClintic-Marshall Co.; G. A. Hughes, Truscon Steel Co.; A. G. Miller, H. Miller & Sons Co., Pittsburgh; G. W. Shem, Alliance Structural Co., Alliance, O.; R. L. Templin, chief engineer of tests, Aluminum Co. of America; C. V. Witt, president, Superior Steel Pipe Co.; T. A. Mellon, Mellon Stuart Co.; Geo. F. Wolfe, Dravo Contracting Co.; A. D. Graves, Morgan Engineering Co.; Commander H. E. Russell, U. S. Naval Bureau of Construction; Geo. L. Christy, Pittsburgh-Des Moines Steel Co.; C. E. Loos, American Bridge Co.; I. L. Porter, president, Union Storage Co.; E. E. Shann, Petroleum Iron Works; P. S. Whitman, Peter Conley Co.; J. B. Huff, Heyl & Patterson; L. D. Reilly, plant manager, American Bridge Co.; L. H. Miller, Duquesne Light Co.; B. Summer, Summer Engineering Co.; M. F. Hasbrouck, Hasbrouck Co.; A. K. Robertson, Newport News Shipbuilding and Dry Dock Co.; A. B. Churchill, master mechanic, American Bridge Co.; Fred H. Williams, test engineer, Canadian National Railways.

Machinery Exports Higher in Month of June

Exports of industrial machinery from the United States during the month of June totaled $11,114,816, as compared with $10,974,403 for the corresponding month of 1925, and $12,273,853 for May 1926, according to the industrial machinery division of the Department of Commerce.

Metal-working machinery exports during June amounted to $1,382,444 and represented a decline of approximately 22 per cent from the $1,788,502 figure recorded during June of last year. Compared with May, 1926, exports of metal-working machinery during the month under review showed an increase of $63,204 or nearly 5 per cent beyond the total of the exports of this class of industrial machinery shipped within the preceding month. The June exports of metal-working machinery for the current year were classified as follows: Power-driven metal-working machinery $1,024,252; other metal-working machinery, $358,192.

First Meeting to Study Human Relations in Industry

The first meeting of the council of the International Association for the Study and Improvement of Human Relations and Conditions in Industry (Zurich) was held at the Rigi-Scheidogg, Switzerland, from July 10 to 15, thirty-five persons from eleven different countries taking part in the meeting. These countries were America, Austria, Denmark, France, Germany, Great Britain, Holland, Hungary, Italy, Sweden and Switzerland.

The association was formed as a result of the International Industrial Welfare (Personnel) Congress, held at Flushing, Holland, in June 1925, a full report of the proceedings of which has been published.

In addition to the meetings dealing with the organization, a general discussion was held on the subject of the development of scientific methods in industry and their effect on those taking part. This was introduced by Lillian M. Gilbreth, Ph.D., consulting engineer, Montclair, New Jersey, U. S. A., wife of the late Frank B. Gilbreth, authority on industrial management.

Referring to the special needs of the present time, Mrs. Gilbreth laid great stress on the development of the human sciences in industry, and the necessity for their co-ordination.

Mrs. Gilbreth dwelt chiefly on the question of the elimination of unnecessary fatigue. Under this heading an illuminating survey was made of the different aspects to be investigated, which created deep interest. As a result it was decided to take up this subject for study during the following year and to hold a summer school dealing with this in connection with the 1927 meeting of the council.

Surveys of the position with regard to the human aspects of scientific management were given by reporters present from the various countries, including a general statement by a representative from the International Labor Office, at Geneva.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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LOOKING over the trade papers and reports, one finds himself impressed by the number of encouraging statements published. President Coolidge is said to "find trade conditions favorable," while the Department of Commerce and the Federal Reserve Banks are singing an antiphonal chorus whose main theme is the prosperity of the nation.

The stock market is booming again under the leadership of U. S. Steel and General Motors whose earnings are sensationally big; and wheat, corn, copper, cotton goods and cotton have developed a strength that has surprised many.

As usual when there is anything like consonance in the price movement, there are many who attribute it to some basic and all-inclusive influence. Thus an advance is explained by an allusion to inflation and deflation is assigned as the cause of any general decline.

But in so far as the United States is concerned these terms have probably been overworked. The development of the Federal Reserve Banks and their huge reserves of gold have added enormously to our fund of bank credit. The use of this credit has been greatly extended by installment buying and in other ways, but except as the decreased purchasing power of money is reflected in the higher wage scale there has been no inflation as it is conventionally defined.

In France on the other hand we have an example of true inflation. Prices there are about 800 per cent of those prevailing before the war, because the international value of the franc has fallen correspondingly. Nothing of the sort has happened in the United States but the profits earned by the railways and many large and small corporations have increased amazingly nevertheless, while the supply of investment capital seems to be almost unlimited.

If they are candid most men whose business experience antedates the war will admit that present conditions seem unreal. Hence it is argued that they are too good to be true and that sooner or later we must get back to the level of 1912-13.

In support of this pessimistic view attention is called to the condition of agricultural and the claim that the tariff has made it possible for one half of the people to prosper at the expense of the other half.

It is alleged that the farmers are able to enforce their demands for protection; that the result will be a more widely diffused but less obvious prosperity, and that there will be a reaction in industry when the stimulus it now enjoys is divided with agriculture. Governor Lowden puts the idea euphemistically in saying that "We must contrive some way to make the tariff serve agriculture equally with industry."

This may be an unattainable counsel of perfection but the insistence with which it is urged bespeaks a dissatisfaction with present conditions that is, so to speak, the only fly in the ointment of the prevailing optimism.

What's Doing in Industry

July closed with a volume of business in the machinery and machine tool trade that gives much cause for optimism. Orders in most of the important industrial centers are ahead of last year and present inquiry gives promise of an equally active month in August. Railroads and automobile manufacturers have supplied most of this activity, with industrialists doing a moderate share.

In Cincinnati the demand has been fair in the past week, but prospects are bright for future business. Detroit reports a slow but steady increase in sales to the automotive industry, with contemplated shop expansions promising good fall business. In Chicago sales are ahead of last year and considerable business is pending. Cleveland reports increased activity among machinery users.

The New York market continues active, some fair orders having been placed by railroads. Buffalo is quiet now but the fall outlook is bright. The automobile industry promises good business in the Milwaukee district, and a fair increase is reported from Philadelphia dealers.

Export figures just released by the Department of Commerce show that foreign sales of industrial machinery in June totaled $11,114,816, almost a million dollars more in value than in the same month of last year, but slightly below the mark of May of this year. The specific class of metal-working machinery showed a 5 per cent increase in June over May.

The financial debacle that seemed to threaten in France last week has been at least deferred by the support given to coalition ministry of which Poincare is the head and the British coal strike seems a little nearer settlement.

Distributive trade is distinctly better. The dry goods market in particular has been much more active, and cotton fabrics are more in demand than for months.

Wheat and corn have also been responsive to unfavorable crop news, although the harvest is in the main satisfactory and the world's supply of wheat promises to be about as large as it was last year. The course of grain prices is therefore chiefly dependent upon the psychology of the trade and the speculative community.

At 5.80 refined sugar is at the highest of the year and raws are slowly following, although the weariness of Cuban holders still gives the buyers an advantage. Wool is a shade lower in London, but woolen goods are unchanged here. The Brazilian control of coffee prices is unrelaxed, and America continues to buy from cup to mouth. Rubber is in an odd situation. Under the Stevenson plan the production will be curtailed by 20 per cent if the average London price for the quarter ending July 31 is under 21 pence. As the average up to July 27 was 21.038 those who want lower prices have been supporting the market in an effort to avert the restriction that will otherwise be ordered. As the London average has to be officially ascertained, the result will not be known until next week. Copper is up to 14¾ with increased talk of a world-wide combination of producers. There is no question about the supply. It will be as much or as little as the great copper companies decide.

The steel mills are said to be working at 80 per cent of capacity, which is about normal for midsummer and earlier reports of a slight decline in building activity are confirmed by the reports recently published.

But if more buildings are required they will certainly be put up for satiety seems the only reason for a reduced demand in this wonderful country of ours.

As one contemplates these figures, he can have no misgivings for the future provided it is not discounted too far ahead. This proviso is introduced, because some of the drafts that are now being drawn upon our prospective prosperity seem to have a rather distant maturity.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cleveland

A little more activity was noticeable in the local machine tool market in the past fortnight. With orders booked and about to be closed it is expected that July will exceed June in the sales total.

The outstanding feature of this upward trend of business has been the renewed buying by the automotive and affiliated interests. Chevrolet and Packard were recent buyers in the local market.

The automatic machine business continues to be the best. Additional orders are reported and inquiries show improvement.

Business in the planer division is good, the Aluminum Co. of America bought a 48-in. planer for its Canadian plant.

The only discordant note is in the punch and shear and used tool lines.

Detroit

Sales of machinery and machine tools in Detroit and other automobile centers in southeastern Michigan are slowly but steadily increasing, and leading representatives of machinery manufacturers expect a brisk business by fall.

Most factories are buying some equipment, but no large orders of consequence are reported outside the General Motors plants, principally Pontiac and Chevrolet.

The Wilson Foundry and Machine Co. of Pontiac, which manufacturers Knight engines for the Willys-Overland Co., has been buying during the past two weeks. Several boring machines have been installed, and many departments are being strengthened.

One of the biggest developments in the machine tool field to occur in months in Detroit is the inauguration of the new method of profiling the Ricardo head at the Packard plant. Engineers of the Packard Motor Car Co. have taken an advance step over other motor car manufacturers in adopting this new method which enables them to obtain cylinder heads with little deviation from absolute accuracy. Some of the old machines at Packard have been revamped, while many new machines have been purchased.

With the exception of the Ford plants every manufacturer in Detroit is close to peak production. New models in many lines have caused a demand for higher priced cars. Machines are being placed in practically every manufacturing establishment, but in a majority of cases the new machines are to meet a specific purpose and are built to blueprints worked out by the machine tool manufacturer and the automobile engineer.

Cincinnati

While business was not at all brisk in the Cincinnati machine tool market in the past week the demand is reported to have been fair. What slackness of trade there was caused no apprehension, it being attributed to the fact that it is now vacation season and a great many buyers are away from their desks.

Manufacturers and selling agents agree that conditions in business in general and in the machine tool trade in particular are decidedly better than at this time last year, and there is a common feeling that the outlook for substantial sales increases in the early fall is good.

The principal part of the week's orders called for single tools, for replacement purposes, from general machinists and industrial users. The sales were well scattered and well diversified. The volume of inquiries received was considered good for the season, these indicating an encouraging number of good prospects.

Although the sales to concerns in the automotive industries were small, there is a feeling that a large number of good-sized orders will come from this market in the very near future. Railroads bought a few single tools, and likewise there is a feeling that they will buy much more freely in the near future. Signs of greater activity among manufacturing machinists are seen, and increased sales in this market are anticipated.

Orders booked, together with those coming in, it is stated, will easily maintain production at a normal level.

New York

Dealers and manufacturers' agents report a fair degree of activity in this market. Sales of machinery and machine tools have been above the normal volume for this season and indications are that this activity will continue through August.

July proved to be a good month for most dealers. Few large orders were recorded, but the number of single pieces sold and the better business reported in small tools and shop equipment made a very favorable total.

Railroads were quite active in the past week. Orders were received from the Illinois Central, the New Haven, the Reading, the Boston & Albany, the Chicago & Northwestern and the Atlantic Coast Line. These orders were mostly for heavy roundhouse equipment and included boring mills, axle-turning lathes, car-wheel borers and engine lathes.

Industrial users of machinery also patronized the market for equipment which included 9 milling machines, 5 geared-head lathes, 2 rotary surface grinders, 2 jig boring machines, and 3 turret lathes.

The flow of inquiries for various types of machinery has continued and quotations are more readily acceptable than at other times. The opinion is strong that good business will prevail through the rest of the summer.

Philadelphia

Gear manufacturers and producers of small tools report a favorable outlook for their industry in the Philadelphia area. The small tool manufacturers are looking forward to a larger volume of business from agriculture centers, this being based upon the fact that these centers have not made extensive purchases for their needs for several years.

While producers have received few orders during the last year from industrial centers, the belief prevails that small tool consumption has increased. This is based on the theory that dealers and jobbers have been disposing of their stocks and soon will be in the market for quantity buying.

The production of gears during the last six months has been about 25 per cent better than it was a year ago, with the outlook favorable for a continuation of that situation. The automobile industry continues to thrive, and there is not yet any apparent slackening in the building trades. Business among the larger machine tool producers continues on a satisfactory plane, it was reported.

Firms engaged in repair work find business better than it was a year ago. Demand for portable machinery for repairing locomotives has fallen off.

Chicago

Conditions in the machine tool market vary little from those last reported. Some slight falling off in the demand for small tools is noted, but dealers in both new and used machinery say, generally, that sales for July have gone beyond expectations, exceeding those of June by a good margin, and being considerably in advance of the corresponding month last year.

General industry throughout this section is responsible for the greater part of the business being done. Demand from the automotive industry has not shown signs of activity, nor is it expected to do so before fall. Some of the railroads are closing on lists issued early this year, and considerable figuring on prices is being done by concerns competing for this business. The Santa Fe, Northwestern and Burlington are the principal roads now in the market. Inquiries have been received from the Chicago Board of Education for some small lots of special machinery, but it is not thought this branch of the city government will furnish any amount of additional business this year, the tech schools having been well equipped in 1925. Such buying as the department may do later on will consist largely of replacements.

The situation in the machinery trade, as a whole, is reported to be much better than the outlook indicated earlier in the year, and dealers are optimistic that there will be no change for several weeks to come.

Milwaukee

While surface indications of a broad or brisk demand for metal-working equipment of all kinds are generally absent, still there is a degree of activity apparent that is causing substantial optimism among those who are wont to compare the midsummer season with that of a year ago. Tool trade most certainly is more active than in July-August, 1925, although by comparison with the past winter months, the demand has subsided. On the other hand, inquiry is coming out which seems to portend a volume of business for the coming winter season that will approximate the last.

Sales of tools for export are not imposing so far as the actual number is concerned, but the fact that orders are coming from beyond the borders of the United States is agreeable.

It is becoming more and more certain that the tooling needs of automobile factories are going to be larger than was expected. Orders already are being placed for equipment that will be needed when the production for the 1927 spring market sets in earnestly. It will require the time between now and the time of need to fabricate the equipment and make deliveries.

Meanwhile machine tool plants are operating without recession and still complain of a shortage of skilled labor that seems to be general in Milwaukee and nearby machine shops.

Buffalo

The quietude of the present demand for machinery and industrial equipment is believed to be due to the summer vacation season. Even so, business is much better than it was last summer and the prospects for early fall business are considered exceptionally good.

There was little change in the condition of business during the last two weeks. The chief activity continues to be in electrical equipment. For several months this has been true. The demand for contractors' equipment continues good, although it is somewhat quieter than it was a month ago.

New England

Buying of machinery in the New England territory during the past week was fairly active, with business for the automotive and rail industries in preponderance. For the most part the business was of the replacement variety, although there were indications here and there of buying for expansion. This was especially so in the buying for the automotive industry.

The volume of export business continued satisfactorily. The buying for German and Italian corporations was considerable. Generally speaking the export business is running 15 to 20 per cent better than a year ago.

There is a substantial volume of prospective business, judging from the inquiry mail, and there are excellent prospects in the contracting field.

Japanese Markets Reflect Prosperity of American Business Conditions

BY OUR TOKIO CORRESPONDENT

Perhaps the most significant development in the Japanese market situation is the fact that the depression which set in after the collapse of the commodity markets (due to the rising yen and the smash in Wall Street) has, during the last month, been succeeded by a wave of optimism. The country's stock exchanges are reflecting the feeling that the American market for silk will be good for some time to come, while losses incurred during the ascent of the yen have been written off. In spite of every consideration, Japan's cotton yarn and cloth markets are expanding. Spinning shares are most popular on the Tokio Stock Exchange.

For the first time in more than a year, the wholesale cost of living index showed a gain over the preceding month.

The Factory Law, prohibiting work in the midnight hours for women and children, became effective on July 1, but occasioned no embarrassment, as the manufacturers had been making their plans to meet the situation for months. Additional spindles and looms are being installed.

Advices from New York stating that arrangements are being made there for the flotation of a $50,000,000 loan to the city of Tokio, on the credit of the Japanese government, are responsible for some of the optimism which is in the air at present. As the loan will be largely used for purposes of earthquake rehabilitation, construction companies are anticipating greatly increased business.

The rayon industry has been making stupendous gains during the last few months and about a dozen new plants, all backed by influential interests, are being constructed. The profits realized from the artificial silk, which has become the fashion in Japan, seem fully to justify expansion and there should be a good market for the right type of machinery.

Muslin and woolen companies are undergoing readjustments and should not be in the machinery market for some time to come. Mismanagement and slack markets have brought them heavy losses, amounting to as much as 20,000,000 yen for the last fiscal term. Some are being taken over at reduced capitalization. Others are to be absorbed.

Treasury Department Aids Against Dumping

After an investigation at the instigation of domestic manufacturers, the Treasury Department has issued an order under the anti-dumping law providing for the application of that act to importations of common and safety pins from Germany. Several of the domestic producers alleged that the existence of their business was threatened by the low prices at which the German pins were being sold in the United States. The Treasury's investigation convinced officials of that department that the imported pins were being offered here at less than their fair market value in Germany. Under the orders, collectors of customs will assess sufficient penalty to the tariff duty to bring the landed cost of the pins to the fair market value in Germany, plus the duty.

Leipzig Trade Fair Will Attract Many Buyers

The Leipzig Trade Fair will be held this year from Aug. 29 to Sept. 4. More than 10,000 exhibitors are expected to take part, of whom about 2,500 will send exhibits of machinery. All nations are cordially invited to display their products. An opportunity is thus offered for American manufacturers of machinery of every kind, to exhibit their products in friendly rivalry with those of Europe. More than a score of countries will take part.

Upwards of 180,000 buyers are expected to attend the fair this fall. Judging from previous fairs, buyers will be gathered from more than forty countries in all parts of the world.

The United States has taken a lively interest in the recent fairs at Leipzig and sent some 1,500 buyers to examine, compare and purchase these goods. The exhibits usually require some 4,000,000 sq.ft. of floor space. They are housed in about 100 buildings, which compare favorably with those of other great world expositions. Several countries, including Austria, Italy, Switzerland, Szechoslovakia, Hungary and Russia have erected special buildings, to display their products, and it is planned to have one also for American wares in the future. All information as to rates for exhibition space at Leipzig and other data may be obtained from the Leipzig Trade Fair Inc., 630 Fifth Ave., New York.

U. S. Gets Most of Mexican Machinery Business

Mexican imports of machinery for industrial purposes showed an increase in 1925 of more than $2,000,000 over those of the preceding year, according to official Mexican customs statistics. The year 1924, in turn, also represented an improvement, although slight, over 1923. The total imports of this class of machinery during the past three years were as follows: 1925, $19,716,560; 1924, $17,468,112; 1923, $17,136,731. United States maintains a strong position in the machinery trade.

The most important competitors in this market, in their order of rank, are the United States, Germany and Great Britain. The American share in this trade, although decreasing slightly as compared with the years 1924 and 1923, has been fairly well sustained.

Railroad Foremen in Convention

With a well-balanced program divided into six main topics, the International Railway General Foremen's Association will hold its annual convention at the Hotel Sherman, Chicago, Sept. 7 to 10. H. E. Warner, president of the organization, will preside.

In order to facilitate the covering of the major subjects to be taken up at the convention, the committee in charge has laid out a program of procedure to be covered in six main topics as follows: "Balancing Shop Sub-Departments," "Development of the Mechanic," "Maintenance of Refrigerator Cars," "The General Foremen's Responsibility for Material Surplus or Shortage," "Developing Railroad Shop Foremen," "Modern Shop Equipment as a Factor in Increased Production."

Each of these topics will be thoroughly discussed and men prominent in the railroad industry will lead the sessions.

Business Items

The Consolidated Tool Works, Inc., announce the removal of their New York office to 136 West 52d Street.

The A. R. Williams Machinery Co., of Vancouver, B. C., has been appointed exclusive sales representative in British Columbia and the Yukon for the Cleveland Planer Co., of Cleveland.

The Kuhlman Electric Co., of Bay City, Michigan, manufacturer of power distribution and street lighting transformers, announces the establishment of a factory office at 3-260 General Motors Bldg., Detroit, Richard P. Johnson will have charge of this office.

The Louis Allis Co., manufacturer of electric motors, of Milwaukee, announces the appointment of the following agents: The C. R. Reynolds Co., Toledo, Ohio; the Southern Engineering Co., Birmingham, Ala.; the Electron Engineering Co., New Orleans, La.; and D. H. Hull, Memphis, Tenn.

The Continental Tool Co. of Detroit, has placed a contract for a large addition to its plant on McGraw St. The new structure will be a machine shop containing approximately 30,000 sq.ft. of floor space. Together with equipment the plant will call for the expenditure of $250,000. The firm specializes in the manufacture of special tools for the automobile industry.

The Vancouver Engineering Works, Vancouver, British Columbia, announce the election of a new directorate, consisting of Eric Davies, chairman and general manager H. H. McDougall, W. Martin Griffin, and M. H. Leggatt. The company was organized in 1901 to take over the plant of Armstrong & Morrison. In 1906 the works were moved to their present site.

Manning, Maxwell & Moore, Inc., of New York, announce that they have taken over the distribution in the metropolitan territory of grinding wheels manufactured by the Norton Co., of Worcester, Mass. These grinding wheels will be handled as a specialty by men familiar with grinding problems and operations and a complete stock of all types and sizes will be carried in New York. R. B. Fuller, formerly of the Carborundum Co., is in charge of this department, which is under the supervision of the railway and mill supply division of the company.

The Kingsbury Machine Co., of Keene, N. H., will occupy a new building about the middle of August. The building is of brick and steel construction, one-story high with monitor roof extending over the central portion. The central section under the monitor will be used for assembling, and will be served by an electric bridge crane. A corner of the factory, 30x40 ft. in area, is closed off with a wood and glass partition for office purposes. The lower floor will have the factory offices and engineering department, and the upper floor will be divided into three rooms; an office for the manager, a small experimental department, and locker rooms for the factory and office.

Executive Changes in National Acme Co.

A. W. Henn, one of the founders and for many years president of the National Acme Co., resigned on July 28 to become chairman of the board. He was succeeded as president by Fred H. Chapin, until recently vice-president of the Bourne-Fuller Co., in charge of the Upson works.

The change is being made, it was said, that Mr. Henn might shift some of the responsibilities of chief executive onto younger shoulders.

Mr. Chapin for twenty years was associated with the Hydraulic Pressed Brick Co. of St. Louis. Resigning from that company in 1919 he joined the Bourne-Fuller forces and for some time has been in charge of the Upson works of that company.

Mr. Henn has been president and treasurer of the company for several years. He was succeeded as treasurer by G. J. Steinbicker, former controller, while K. N. Crumrine was made superintendent of the Coit plant. Mr. Crumrine formerly was connected with the company's plant at Windsor, Vt. No other changes were announced.

Personals

EDWARD P. WELLES, president of Chas. H. Besly & Co., has just returned from a three-months' trip to Europe.

S. W. TAYLOR has been appointed factory manager of Copeland Products Co., Inc., of Detroit.

GEORGE S. PIROOMOFF has been appointed assistant to the chief engineer in charge of transportation for the White Co.

EDWARD A. KERR has become associated with the Chapman Valve Co. at New York.

RICHARD T. GIFFORD has resigned as factory manager of the Stuebing-Cowan Co., Holyoke, Mass.

RALPH K. MASON has resigned as president of the Trumbull-Vanderpoel Electric Manufacturing Co., of Litchfield, Conn.

HERBERT P. CROXTON has established headquarters at the Cleveland office of the Air Reduction Sales Co.

ALFRED CARLSON, formerly assistant to the superintendent of the Otis Elevator Co., has joined the sales division of Henry Prentiss & Co., New York.

I. D. PARKER has resigned as secretary of the Burke Machine Tool Co., of Conneaut, Ohio. He has been succeeded by H. Rockwell, superintendent of the company.

JOHN G. MATHEWS is now proprietor and general manager of the Berea Machine and Tool Works, Berea, Ohio.

C. H. LAGE has been appointed general foreman of the truck department of the International Harvester Co., at Davenport, Iowa.

H. D. RANDALL has been appointed sales manager of the gear section of the General Electric Co. He will have headquarters at the West Lynn Works of the company.

F. A. WHITTEN has been appointed engineer in charge of designs and development for the American Car and Foundry Co., at Detroit.

JOHN HECKLER, master mechanic at the plant of the Standard Steel and Bearings Co., Plainville, Conn., has resigned his position because of ill health.

ALFRED E. SORENSEN has resigned as instructor in mechanical engineering at Rensselaer Polytechnic Institute, and has become associated in a similar capacity with Princeton University.

CHARLES G. PHELPS, treasurer of the Uehling Instrument Co., has opened an office in Paterson, N. J., for the distribution of power plant equipment. Charles J. Schmid is associated with Mr. Phelps.

N. C. MILLMAN, service engineer in charge of the technical division, General Motors, Ltd., Oshawa, Ontario, has accepted a similar position with the General Motors Export Co., New York City.

M. S. PERKINS, of Keene, N. H., is preparing to erect a new machine shop. The building is to be of brick, with a floor space in the main shop of 127x38 ft., with an ell 56x36 ft. The contracts have not yet been let.

FRANS H. C. COPPUS has resigned as president of the Coppus Engineering Co., and has established a business in railway equipment under the firm name Coppus Locomotive Equipment Co.

HENRIETTA WICHERT has been appointed secretary of the Bantam Ball Bearing Co., of Litchfield, Conn. Miss Wichert was associated in an executive capacity for ten years with the Bryant Electric Co., of Bridgeport.

R. J. TEIDEKEN has been appointed raw material salesman for the Bridgeport Brass Co., Bridgeport, Conn. Mr. Tiedeken will have headquarters in the Philadelphia office of the company, which is in the Bankers Trust Co. Bldg.

HERBERT S. FREEMAN, M.E., has been appointed district representative of the Fibroc Insulation Co., of Valparaiso, Ind., manufacturer of "fibroc-bakelite." Mr. Freeman will represent the company in the northern New York territory with headquarters in Rochester.

B. H. ANIBAL, chief engineer of the Oakland Motor Car Co., one of the units of the General Motors Corporation, has been elected vice-president in charge of engineering. Mr. Anibal was formerly an engineering official of the Cadillac Motor Car Co. and with the Peerless Motor Car Co.

ERNEST KANZLER, vice-president of the Ford Motor Co. of Detroit, has resigned to look after private interests of Henry and Edsel Ford. Mr. Kanzler is a brother-in-law of Edsel Ford,

H. G. WELSFORD has been appointed general manager of the Dominion Engineering Works, Ltd., to fill the vacancy caused by the death of John Overn, Jr. Mr. Welsford has been assistant general manager of the company for some time and has been closely identified with its development and expansion.

ALTON FARREL, treasurer of the Farrel Foundry and Machine Co., Ansonia, Conn., was recently elected a director of the Connecticut Chamber of Commerce to succeed Henry Trumbull, a director of the Trumbull Electric Manufacturing Co., Plainville, who was elected second vice-president of the Chamber.

IVAN STEWART FORDE, who for a number of years was manager of the small turbine division of the Westinghouse Electric and Manufacturing Co., and for the past three years manager of the sales promotion department of the Diamond Power Specialty Corporation, has resigned to become affiliated with the Furnace Engineering Co., as sales manager, with headquarters at 5 Beekman St., New York.

DR. W. D. COOLIDGE, assistant director of the research laboratory of the General Electric Co., and inventor of an X-ray tube which bears his name, has been awarded the Howard N. Potts gold medal for 1926 by the Franklin Institute of Philadelphia. The medal, to be formally presented by the Institute on Oct. 20, is "in consideration of the originality and ingenuity shown in the development of a vacuum tube that has simplified and revolutionized the production of X-rays."

LAURENCE THOMPSON has been appointed district manager in Cleveland for the United States Electrical Tool Co., of Cincinnati. Mr. Thompson was formerly Cleveland manager of the Fairbanks-Morse Co. Mr. Thompson is well acquainted throughout northern Ohio, due to his engineering activities in that field, both in industrial and automotive circles. The company also announces that it has appointed Wm. J. McFarland, who has been for a number of years associated with Boyer-Campbell Co., Detroit, in charge of its new Detroit offices, 2-226 General Motors Bldg.

Obituaries

ALBERT M. MAY, president of the Peerless Automatic Machine Co., of Cleveland, Ohio, died at Stamford, Conn., on July 21. He was 70 years old.

CHARLES T. WILSON, for 46 years associated with William Sellers & Co., Inc., of Philadelphia, died at his home in Haddonfield, N. J., on July 18.

FRANKLIN S. TERRY, vice-president of the General Electric Co., died on July 23 at his home at Black Mountain, N. C. He was 64 years old. Mr. Terry had been active in the affairs of the National Electric Light Association.

ROBERT WICKHAM NELSON, president of the American Type Founders Co., died at his home in Westfield, N. Y., on July 29. Mr. Nelson had been associated with newspaper enterprises for many years and was one of the founders of the American company. He was 75 years old.

THOMAS B. ALCOCK, formerly secretary of the Gurney Foundry Co., of Toronto, Canada, died at his home in Toronto on July 25, in his 63rd year. Mr. Alcock joined the company 50 years ago and during his connection with the firm held many important positions.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 1, 2 and 3. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foremen's Supply Association. Annual exhibit in connection with the annual convention of the American Railway Tool Foremen's Association, Chicago, Sept. 1, 2 and 3.

Machine Tool Exhibit. Sixth annual exhibition of machine tools at the Mason Laboratory, Yale University, under the auspices of the New Haven Section, A.S.M.E., the mechanical engineering department of the Sheffield Scientific School, and the New Haven Chamber of Commerce, Sept. 7 to 10. Administrative office, New Haven Machine Tool Exhibit, 400 Temple St., New Haven, Conn.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 7 to 10. William Hall, secretary, 1061 West Wabash Ave., Winona, Minn.

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual production meeting, Hotel Sherman, Chicago, Sept. 21, 22 and 23. John Warner, manager of meetings department, 29 West 39th St., New York.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under the auspices of the American Foundrymen's Association. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

IRON and steel prices remain fairly steady at levels prevailing a week ago. Demand is active in rails and other railway material, steel pipe, tin plates and hot and cold rolled strip steel. Bars, shapes and plates hold to a minimum of $1.90 per 100 lb., Pittsburgh mill, with the first two bringing $2 in single carload lots or smaller. Steel sheets, except black, declined 10c. per 100 lb. at Pittsburgh mills during the week. Non-ferrous metals are tending upward in the principal centers of distribution.

(All prices as of July 30)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.67
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.75
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	19.76
Basic	19.76
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30	3.89	3.15	3.50
No. 12	2.35	3.94	3.20	3.55
No. 14	2.40	3.99	3.25	3.60
No 16	2.50	4.09	3.35	3.70
Black				
Nos. 18 to 20	2.80@2.95	4.30	3.65	3.90
Nos. 22 to 24	2.85@3.00	4.35	3.70	3.95
Nos. 26 and 27	2.90@3.05	4.40	3.75	4.00
No. 28	3.00@3.15	4.50	3.85	4.10
Galvanized				
No. 10	3.20@3.30	4.65	4.00	4.25
Nos. 12 to 14	3.30@3.40	4.75	4.10	4.35
No. 16	3.45@3.55	4.90	4.25	4.50
Nos. 18 to 20	3.60@3.70	5.05	4.40	4.65
Nos. 22 to 24	3.75@3.85	5.20	4.55	4.80
Nos. 26 and 27	3.90@4.00	5.35	4.70	4.95
No. 28	4.20@4.30	5.65	5.00	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60@65%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to 3/16, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.62½
Tin, 5-ton lots, New York			65.25
Lead (up to carlots) E. St. Louis	8.75	New York	9.25
Zinc (up to carlots) E. St. Louis	7.47½	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	16.00	18.50	17.00
Copper sheets, base	22.75	22.75	22.75
Copper wire, base	19.75	19.75	16.25
Copper bars, base	22.37½	22.37½	22.12½
Copper tubing, base	24.75	24.75	24.75
Brass sheets, base	19.12½	19.12½	19.12½
Brass tubing, base	24.00	24.00	24.75
Brass rods, base	16.87½	16.87½	16.87½
Brass wire, base	19.62½	19.62½	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	28.00	27.00	27.02
Zinc sheets (casks)	13.25	12.55	11.76
Solder (½ and ½), (case lots)	40.00	40.00	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			78.25
Commercial genuine, intermediate grade			55.00
Anti-friction metal, general service			30.50
No. 4 babbitt (f.o.b.)			14.25
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 31 00 Electrolytic 38.00 Shot			32.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.25 @12.50	11.25	11.25@11.75
Copper, heavy, and wire	11.50 @12.00	11.50	10.75@11.25
Copper, light, and bottoms	9 75 @10.25	9.75	9.75@10.25
Heavy lead	7.37½@ 7.62½	6.75	6.75@ 7.25
Tea lead	5.25 @ 5.75	4.75	5.50@ 6.00
Brass, heavy, yellow	7.00 @ 7.50	7.25	7.50@ 8.00
Brass, heavy, red	9.50 @10.00	9.50	8.75@ 9.25
Brass, light	5.75 @ 6.25	6.00	7.00@ 7.50
No. 1 yellow rod turnings	8.00 @ 8.50	8.00	7.75@ 8.25
Zinc	4.50 @ 4.75	4.50	4.50@ 5.00

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 13@0. 17½	$0.18	$0.15
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.16
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb	3.60†	3.50	4.25‡
Linseed oil, per gal., 5 bbl. lots	.94½	1.05	.95
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. kegs. †Per 150 lb. lot. ‡Per 425 lb. barrels

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb.	.1687½	.1662½	.1587½
Solder (½ and ½)	per lb.	.40	.3912½	.395
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7 00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5. 84	$5.65
Emery paper	10. 71	11. 00	10. 71
Emery cloth	29.48	31. 12	29. 48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1. 49	1. 45	1. 49
Cloth	3. 55	3. 55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		2.75@ 3.00
Coke, prompt foundry, Connellsville	per net ton		4.00@ 4.50
White lead, dry or in oil	100 lb. kegs		New York, 15.25
Red lead, dry	100 lb. kegs		New York, 15.25
Red lead, in oil	100 lb. kegs		New York, 16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Naugatuck — Eastern Malleable Iron Co., Bridge St.—complete equipment for plant.

O., Cleveland—Glenn L. Martin Co., c/o H. F. Volmer, Supt., 16800 St. Clair Ave.—three milling machines, 3 punch presses and 2 table saws.

O., Columbus—H. Holtzman & Sons Co., 2112 East Main St., C. E. Holtzman, secy.—three shapers, 2 planing machines, 1 moulding machine, 2 cutoff saws, etc., for replace equipment, recently destroyed by fire.

Ill., Chicago—Chicago Steel Fdry. Co., Kedzie Ave. and 37th St.—one 250-350 ton open gap type hydraulic straightening press.

Mass., Boston—City, Schoolhouse Dept. City Hall—sheet metal working machinery for South Boston High School.

Mich., Detroit—Chevrolet Motor Co., Holbrook and St. Aubin Aves.—Ferguson automatic H. T. furnace, 2,500 lb. hammer, 60, 36 and 30 in. planers, shapers, and 16, 28 and 36 in. lathes, etc., for proposed addition to forge and heat treating building.

Mich., Marquette—E. B. Longyear, Marquette—medium sized lathe.

N. Y., Buffalo—Day School, for Crippled Children, 462 Girder St., G. S. Staniland—manual training equipment.

O., Canton—Timken Roller Bearing Co., Harrison Ave.—special milling machine for milling housings for freight car axles.

Wis., Milwaukee—Engel Tool & Forge Co., 338 Davidson St.—punch press for proposed tool factory.

Que., Vielle Eglise—Bernier & Bernier, Vielle Eglise Ave.—general foundry equipment.

Ont., Belleville—National Castings Ltd., N. Turner, mgr.—complete foundry equipment, to replace fire loss.

Ont., Brantford — Canadian Radiators Ltd.—equipment for manufacture of auto radiators and parts. $50,000.

Ont., Walkerville—Ice Matic Refrigeration Co.—equipment for manufacture of electric refrigerators, $100,000.

Opportunities for Future Business

Calif., Long Beach — Ford Motor Co., Highland Park, Detroit, Mich., plans the construction of an auto manufacturing plant on 40 acre site here.

Calif., Los Angeles—American Can Co., 4815 Santa Fe Ave., will build 2 story, 150 x 660 ft., warehouse and plant and 125 x 150 ft. factory, at 49th and Santa Fe Sts. Estimated cost $600,000. Private plans.

Calif., Los Angeles—Chapman Bros. Co., 2469 West 6th St., is having plans prepared for the construction of a 6 story, 90 x 275 ft. garage, on West 6th St. Estimated cost $150,000. R. H. Orr, 1305 Corporation Bldg. Archt.

Colo., Denver—Denver Rock Drill Mfg. Co., East 39th Ave. and William St. is having plans prepared for the construction of 1 story plant addition, here. Estimated cost $30,000.

Conn., East Hartford (mail Hartford)—New York, New Haven & Hartford R.R. Co., Grand Central Terminal, New York, N. Y., will build 1 story, 200 x 800 ft. machine shop, here. E. Gagel, New Haven, ch. engr.

Conn., Naugatuck — Eastern Malleable Iron Co., Bridge St. plans the construction of new foundry building, at plant, here. $82,000.

Conn., New London—Broad Street Auto Co., Broad St. is having preliminary plans prepared for the construction of 1 story, 120 x 175 ft., garage, and service station, Broad St. Estimated cost $100,000. F. DeGrange, 60 Ocean Ave., Archt.

Ga., Atlanta—Southern Wire & Iron Wks., 53 Martin St., plan the construction of a 1 story, 200 x 200 ft. plant, here.

Ill., Chicago—Wood Hydraulic Hoist & Body Co., 3136 Wabash Ave. awarded contract for the construction of 1 story, 50 x 100 ft., 50 x 300 ft. and 50 x 80 ft. additions to plant at Southwest corner of 37th St. and Princeton Ave.

Ill., East Moline—Deere & Co., Moline awarded contract for the construction of 2 story, 100 x 120 ft. foundry, etc. for plow works, here. Estimated cost $150,000.

Ill., Galesburg — Coulter-Disc Co., Monmouth Blvd., R. C. Ingersall, pres. awarded contract for the construction of 48 x 50 ft. and 125 x 125 ft. plant for the manufacture of auto parts, here.

Ill., Galesburg—T. W. Petersen, 563 North Academy St., awarded contract for rebuilding foundry and remodeling 50 x 60 ft. shop, on South Chambers St. to replace plant recently destroyed by fire. Midwest Fdry. Co., 257 South Chambers St., lessee.

Ind., Bloomington — School Trustees awarded contract for the construction of school, with vocational shops, etc. here. Estimated cost $150,000.

Mass., Amherst—M. S. Paige, Amity St., is receiving bids for the construction of 1 story, 60 x 100 ft. repair and service garage. Estimated cost $40,000. Putman & Stuart, 78 Main St., Northampton, Mass., Archts.

Mass., Boston—Morgans Furniture Co., 755 Washington St., is taking bids for the construction of 6 story, 69 x 140 ft. warehouse and 1 story, 65 x 125 ft. garage on Massachusetts Ave. Estimated cost $150,000. I. Richmond, 219 Boylston St., Archt.

Mass., Cambridge—Lesser & Devine, c/o Miller & Levi, 46 Cornhill, Boston, Archts., are receiving bids for the construction of 1 story, repair and service garage, on Main St. between Albany and Portland Sts. Estimated cost $100,000.

Mass., Melrose — City, Pub. Buildings Dept., is taking bids for the construction of a 1 story, garage and repair shop, here. Estimated cost $40,000. C. R. Greco, 11 Beacon St., Boston, Archt.

Mass., Somerville—Cambridge Machine & Tool Co., 234 Washington St. awarded contract for the construction of 1 story, factory on 150 Medford St.

Mass., Wakefield—Wakefield Garage Mfg. Co., T. J. Quinn, owner, awarded contract for the construction of 1 story, 40 x 100 ft. factory at Lowell and Vernon Sts. Estimated cost $40,000.

Mass., Woburn—Massachusetts Gear & Tool Co., 30 Nashua St. is taking bids for the construction of a 1 and 2 story factory addition on Nashua St. Estimated cost $40,000. Private plans.

Mo., Kansas City—Missouri Casket Co., 2106 East 9th St., is having plans prepared for the construction of a factory. Estimated cost $75,000. H. Von Unwerth, Finance Bldg., Archt.

Mo., Kansas City — Motor Accessories Corp., 1801 Wyandotte St. is having plans prepared for the construction of 1 story, 90 x 130 ft., factory, 2537 Madison St. Estimated cost $40,000. E. H. Gill, 4906 Michigan Ave., Archt.

Mo., St. Louis—George T. Burdeau Realty Co., 801 Chestnut St., will build a 1 story, 130 x 200 ft. sales and service station on West Pine St. Estimated cost $150,000. Federal Motor Truck Co., 1800 Park Ave., lessee.

Mo., Webster Groves (St. Louis P. O.)—Tate Motor Co., 2001 Locust St., St. Louis, awarded contract for the construction of a 2 story, 125 x 145 ft. repair and service garage on Lockwood St. here. Estimated cost $150,000.

N. J., Roselle—Rapid Adding Machine Co., 845 Broad St., Newark, awarded contract for the construction of 1 story, 177 x 321 ft. factory, here, $150,000.

N. Y., Long Island City—Gould & Mersereau, 194 13th St., soon receives bids for the construction of 2 story, 90 x 210 ft. hardware factory addition, Mott Ave., here. Estimated cost, $150,000. Parker & Shaffer, 280 Madison Ave., New York City, Archts.

O., Canton—Timken Roller Bearing Co., Harrison Ave., soon awards contract for the construction of 1 story, 100 x 500 ft. bearing factory, on Garfield Ave., S. W. Estimated cost $250,000.

O., Cleveland — Buckeye Forging Co., 10205 Harvard Ave., J. W. Baxter, pres., awarded contract for the construction of 1 story, 51 x 61 ft. machine shop and 50 x 60 ft. forge shop at 10207 Harvard Ave. Estimated cost $40,000.

O., Cleveland—McKinney Tool Co., E. W. McKinney, pres., 15215 Utopia Ave., awarded contract for the construction of a 1 story, 40 x 100 ft. factory, Roseland and Arabell Aves. Estimated cost $40,000. Noted July 22.

O., Cleveland—W. S. Tyler, East 36th St. and Superior Ave., had plans prepared for the construction of 2 story, 98 x 106 ft. ornamental iron and bronze factory, on East 36th St. Estimated cost $75,000. G. S. Kider Co., Century Bldg., Archt., and Engr.

O., Dayton—Parker Airplane Co., Anderson, Ind., plans the construction of a 2 story, 150 x 200 ft. plant for the manufacture of airplanes. Estimated cost $85,000. Architect and engineer not selected.

Pa., Pittsburgh—Alleghany County will soon award contract for the construction of a 1 and 2 story, 61 x 128 and 83 x 89 ft. garage on S. McKean St. Estimated cost $150,000. S. Rouch, 519 Smithfield St., Archt.

Tex., Houston—Crain Ready Cut House, c/o E. L. Crain, pres., plans the construction of factory to replace plant recently destroyed by fire. Estimated cost $150,000. Engineer and architect not selected.

Wis., Cedarburg—Amer. Electric Motors, Inc., 57 Erie St., Milwaukee, is receiving bids for the construction of 1 story, 100 x 300 ft. factory, here. Private plans.

Wis., Janesville—Chevrolet Motor Co., 5804 Woodward Ave., Detroit, will soon award contract for the construction of a 150 x 645 ft. addition to factory. Estimated cost $200,000. A. Kahn, Marquette Bldg., Detroit, Mich., Archt.

Wis., Wausau—Hammerblow Tool Co., 602 3rd St., awarded contract for the construction of 2 story, 40 x 70 ft. factory, here. Estimated cost $40,000.

B. C., Vancouver—Allan & Boultbie, 578 Seymour St., will soon receive bids for the construction of 6 story, 120 x 150 ft. ramp type garage, at Seymour and Georgia Sts. Estimated cost $220,000. Sharp & Thompson, 708 London Bldg., Archts.

Ont., Niagara Falls—Canadian Natl. Rys. Co., Montreal, Que. and Wabash Rys. Co., Exchange Bldg., St. Louis, Mo., are having plans prepared for the construction of new shops and turntable here. Estimated cost $500,000. R. H. Howard, St. Louis, Ch. Engr. Wabash Ry. and C. S. Gzowski, Ch. Engr. Canadian Natl. Ry.

Ont., Niagara Falls — Niagara Wire Weaving Co., Robinson St., awarded contract for the construction of addition to factory, here. Estimated cost $60,000.

Ont., Oshawa—General Motors of Canada, 52 Mary St., awarded contract for the construction of first unit 1 story, 90 x 690 ft. plant addition for manufacture of Pontiac Car. Estimated cost $500,000.